ELEMENTS

OF

MODERN MEDICINE;

INCLUDING

PRINCIPLES OF PATHOLOGY, AND THERAPEUTICS, WITH MANY USEFUL MEMORANDA AND VALUABLE TABLES FOR REFERENCE.

DESIGNED FOR THE

USE OF STUDENTS AND PRACTITIONERS OF MEDICINE.

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Indocti discant, et ament meminisse periti.

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TO THE ALUMNI

OF THE

MEDICAL DEPARTMENT OF THE UNIVERSITY OF PENNSYLVANIA

THIS WORK IS RESPECTFULLY DEDICATED

BY THEIR OBEDIENT SERVANT,

THE AUTHOR.

PREFACE.

The belief that a work of condensed form, embracing the most important facts and observations which mark the progress of scientific and practical medicine, would be of valuable aid to medical students, as well as a useful book of reference for the general practitioner, has led to the appearance of this publication.

As indicated on the title-page, the work is *elementary in character*, and is not intended to supplant any of the many excellent and elaborate volumes comprising the details of medicine. But it has been suggested that an abridged work, presenting the more advanced views of leading authorities throughout the world with reference to *general pathology and therapeutics*, considered in connection with certain other points of practical importance, if arranged for convenient and ready reference (and of suitable form to be carried in the pocket), might prove of infinitely more value to a busy practitioner than many larger and more cumbrous volumes which fill the shelves of our libraries.

To meet this requirement, the main object of the author has been to collate from the transactions of learned medical societies, recent medical periodicals, monographs, and systematic treatises, the utterances of the most experienced representatives of modern medicine, so far as they relate to a knowledge of those *general principles* which may be considered indispensable to the proper investigation and treatment of disease.

The design has been to not only present, in a regular and systematic order, the general principles of pathology and therapeutics, and, in the light of present knowledge, to harmonize these principles with one another, but to simplify and to facilitate their application to the investigation and management of individual diseases.

For convenience and comprehensiveness, the contents of the work have been arranged in accordance with these two main divisions of rational medicine. To aid the student and general practitioner in refreshing their remembrance of the most important subdivisions of medical research, an effort has been made to present them in their most interesting garb—that is, in the series of cause and effect.

In the first part of the work, under the head of General Pathology, are included articles relating to the origin, anatomical character, and nature of disease; its course, duration, and termination; its chief symptoms and signs, and their significance; its diagnosis, prognosis, and, lastly, its treatment; and to these are supplemented the many considerations which these topics suggest.

In the second part of the work, invasion of the domain of materia medica has been avoided, except so far as is suggestive of therapeutic

plication; but this division comprehends an improved classification of drugs, followed by articles on the several classes of remedies which are available for purposes of treatment, setting forth their physiological action, indications, and methods of their use. Under these different headings many points of value have been gathered from the most popular teachers of this country and of Europe. Many tables for practical reference will be found at the end of each of the two general divisions of this compendium. The use of italics throughout this publication has been adopted to make conspicuous such points as are deemed of the greatest practical value. The scope of the work will be found to be quite extensive, notwithstanding its small compass, since condensation has been the aim of the author on every page where conciseness was consistent with accuracy of statement, and where brevity did not demand any important omissions.

As practical utility has been the governing principle in the preparation of this work, it is believed that its value as a "*vade mecum*" is greatly enhanced by presenting it in its present form, with pockets arranged upon either side, suitable for containing statements of accounts and clinical registers of important cases.

Having indicated the needs and purposes of this work, the author desires to state that he claims but little more in its compilation than the merit of novelty and utility in its objects and arrangement. But having been a close and almost constant student of medicine for the last twenty-five years, and having had during this time abundant clinical experience as a general practitioner of medicine, in private practice as well as in civil and military hospitals in various parts of the United States, from the Mississippi Valley to the Atlantic seaboard, and from the northern lakes to Key West and the intertropical regions, and bringing to bear to the information thus acquired several years' experience as a teacher of materia medica, therapeutics, and clinical medicine in a Western medical college—he trusts it will not be regarded as egotism to assert his ability to form sound conclusions as to the kind of practical information which should be embodied in a work of this character. In fact, long familiarity with the study and management of disease, a just conception of the powers of nature, and an abiding faith in the resources of medical art from a well-defined knowledge of the uses, effects, and capabilities of remedies, are circumstances which have necessarily enabled the author to form opinions of his own as to the nature and treatment of disease, and these opinions he has not hesitated to express throughout the following pages with reference to many controversial points of pathological and therapeutical importance.

Possibly his notions expressed concerning the nature of contagion and the causation of the essential and of the so-called "specific" fevers may meet with much opposition, especially as they are antagonistic to their cryptogamic and bacterian origin. *The author holds that the now so popular "germ" theory of disease is, as regards its ætiological influence, a fallacy and a delusion; and which, by ignoring and supplanting the known factors of disease and the application of appropriate treatment, is deplorably misleading and impracticable.*

Viewing the causation of fever and of constitutional infectious diseases from the stand-point of physiological perturbation, he believes that the only "germs" that should be recognized as an ætiological factor in this class of maladies are those which are natural to and evolved from the animal body itself while subject to the influence of abnormal conditions, and

that all others found (such as the various forms of vegetable organisms) are the effect, and not the cause, of disease.

To be a skillful physician involves not only a thorough understanding of disease, but the application of the right remedies at the right time and in the right manner. And, in view of this fact, the arrangement of the subjects in this work has been made and planned with special reference to clinical medicine. In the examination of patients, a very comprehensive *scheme of clinical interrogation* has been presented, which is available for purposes of record as well as for careful diagnosis of difficult and obscure cases. In the second part of the work will be found a *selected materia-medica list*, comprising the various classes of remedies and doses, so arranged as to greatly aid the choice of the practitioner in the use of such agents as are designed to act in a given direction. *In this department all important pharmaceutical innovations, adopted by the revisers of the last United States Pharmacopœia, 1880, have been carefully noted.* The author trusts that an interesting and valuable feature of this "Hand-Book" will be found in the *Clinical Retrospect* which completes the second part of the work. This department is designed to represent the latest and most approved formulæ and methods of therapeutics, having reference to the management of the more important diseases and morbid conditions with which the physician is ordinarily required to deal.

In presenting the most recent views relating to morbid conditions of the blood and pathological changes of the solid tissues, the most valuable assistance has been afforded by the writings of Dr. William H. Welch, Professor of Pathological Histology in the Johns Hopkins University, Baltimore. In the article on syphilis, the views expressed with reference to its origin, mode of development, and progress are substantially those of Dr. F. N. Otis, of New York. In the article on tubercle, the author has thought best to express certain conclusions as to its origin and development, which are in opposition to the recent bacillus theory of Koch, but which, he ventures to affirm, are more in harmony with general experience and observation.

While acknowledging his obligation to various sources for the materials of this publication, the author desires to mention his especial indebtedness to such standard works as those of Professor Austin Flint, Sr., Alfred Stillé, H. C. Wood, and T. Lauder Brunton, as well as to numerous and excellent monographs from such distinguished authorities as Richard Quain, Frederick T. Roberts, J. Pearson Irvine, James A. Russell, H. Charlton Bastian, William H. Broadbent, J. Mitchell Bruce, David Ferrier, and Sir James Paget, of England, and E. H. Clarke, J. C. Dalton, Robert T. Edes, Charles L. Hogeboom, E. L. Youmans, and Benjamin W. McCready, of our own country.

The authorities named in the list at the close of this publication, besides those mentioned in the text, have been carefully consulted and freely utilized, to meet the purposes for which this book has been designed. If the author has not realized the ideal which he had in view in planning this compendium, it must be attributed to the difficult task of condensing the extended knowledge of a very wide range of important subjects within the limited space which the nature of this manual could afford. But as his only incentive in its preparation has been the desire to render a service to those for whom it is intended, he trusts that he has, to some extent, succeeded in promoting the acquisition of more accurate knowledge relative to the practical objects of professional pursuit.

And if in these elements of medicine, viewed in the light of the lat-

observations and experience, he has in any degree lessened prevailing skepticism as to the reality of medical science, or the resources of medical art, or aided the reader "*to give a reason for the faith that is in him*," or if, by assisting him in familiarizing himself in succession with the more important subjects of medical research, the *practice of medicine* has been rendered less distasteful, less difficult in its study, and more satisfactory and successful when tested at the bedside, then the chief objects in the publication of this work will have been accomplished.

R. FRENCH STONE.

16 WEST OHIO STREET,
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ELEMENTS OF MODERN MEDICINE.

GENERAL INTRODUCTION.

REVIEW OF THE RECENT PROGRESS AND THE PRESENT CONDITION OF MEDICAL SCIENCE AND OF MEDICAL PRACTICE.

MEDICINE, in the most comprehensive sense, includes everything pertaining to the knowledge and cure of disease. The advance in medical knowledge within the last few decades is unequaled by any other period in the world's history, and is fraught with wondrous importance; whether considered in the possibilities of science not yet applied, or in practical results in the general lengthening of human life, or in those which are no less desirable—the decrease of pain and misery and the prevention of diseases which afflict our fellow-creatures.

In this respect we have now passed that point which denotes the boundary-line separating *ancient* and *modern* medicine. And we may now say with satisfaction, on looking back to a period within one's memory, that there never before was a time since the dawn of medical history that has witnessed so great a zeal in investigation, or when any approximation to a similar advance in knowledge or ability has shown itself among physicians. "In the recent past, problems thousands of years old have been solved," while others are rapidly approaching a sure solution, thus fulfilling the desires of our predecessors to an extent far beyond their hopes and expectations.

Medicine hitherto has been slow to assert its position among the sciences, and can hardly yet be declared to answer a rigid definition of a science (that is, of knowledge governed by law). But medicine is, however, scientific, both in spirit and doctrine. "It has, in fact, become recognized as a part of the science of biology, and may be, to a certain extent, described as the 'applied science of biological doctrine.'" According to the views of Professor Huxley, the logical connection between a purely scientific doctrine of disease or pathology and ordinary biology is easily traced. "Living matter is characterized by its innate tendency to exhibit a definite series of the morphological and physiological phenomena which constitute organization and life. Given a certain range of conditions, and the phenomena remain the same, within narrow limits for each kind of living thing. They furnish the normal and typical characters of the species, and as such they are the subject-matter of ordinary biology. Outside the range of these conditions, the normal course of the cycle of vital phenomena is disturbed; abnormal structure makes its appearance as the proper character, and mutual adjustment of the function cease to be preserved. The extent and importance of these deviations from the typical life may vary indefinitely. They may have no perceptible influence on the general economy, or they may favor it. On the contrary, they may be of such nature as to *impede the activities* of the organism, or even *involve its destruction*. In the first case these perturbations are styled "*variations*"; in the second case they are called "*lesions*," states of poisoning or disease, and, as morbid states, lie within the province of pathology. No sha

line of demarkation can be drawn between the two classes of phenomena, and all that can be said is that whatever change of structure or of function is hurtful belongs to pathology. Hence pathology is a branch of biology and signifies physiological perturbation—in other words, constituting the morphology, the physiology, the distribution, the etiology of abnormal life." Pathology, in the sense defined by Huxley, is regarded as the analogue of the theory of perturbation of the great forces of nature as witnessed in astronomy, and from this point of view therapeutics rests upon pharmacology, which is, strictly speaking, a part of the great biological topic of the influence of conditions on the living organism. The most encouraging indications of the progress of medicine are derived from a comparison of the state of pharmacology at the present day with that which existed forty years ago. When we consider the knowledge positively acquired in this short time, of the *modus operandi* of many of our most potent and commonly used drugs, not only as regards their local action, but also their influence upon the nervous, circulatory, and respiratory system, as well as upon temperature and the secretion and excretion of various glandular organs, there can surely be no reason for doubting that at no distant day the pharmacologist will supply the physician with the means of affecting in any desired sense the functions of any physiological element of the body. And eventually, perhaps, the conception of Professor Huxley may be realized in that "it may become possible to introduce into the economy a molecular mechanism, which, like a very cunningly contrived torpedo, shall find its way to some particular group of living elements and cause an explosion among them, leaving the rest untouched."

Medicine, however, is still to be regarded from two standpoints—the scientific and the empirical. "While there is so much unknown in the study of medicine there must be empiricism in its practice." Knowing little or nothing of certain processes of disease, it is guided by broad results, and that is empiricism. Knowing, from previous investigation, something of certain other processes, it is guided by its knowledge of the causation, and that is scientific medicine. Empiricism will become less conspicuous in medicine with a corresponding advance in physiological knowledge, "and, with the better means thus afforded to test and investigate its assertions, they will the more quickly be reduced to scientific expression." Medicine thus can claim an independent existence as a practical science—not, of course, independent of biology, or the study of the condition and phenomena of life and of living things—but taking rank as one of its distinct and integral divisions. Intimately related to all the other divisions of physical and natural sciences, and freely giving to and borrowing from them, it yet lives and works in a sphere of its own.

Many representatives of modern medicine assume that the study of the intangible vital principle leads to no definite result, and have therefore abandoned its pursuit and even the discussion of its existence, and have devoted themselves to the investigation of the natural phenomena of living bodies so far as they are appreciable by the human senses and intelligence. With them, therefore, the study of life is simply the study of the phenomena, without any attempt to determine its actual nature. Modern physiology recognizes the fact that many of the phenomena presented by living bodies are purely physical or chemical, and are to be studied by precisely the same methods as may other physical or chemical phenomena seen elsewhere. Such as the mechanism of the joints, movements of limbs upon the trunk, extent, force, and rapidity of muscular contraction in general; the changes which take place in the food during digestion, and in the air during respiration; the exhalation and imbibition of various matters by the blood-vessels in the course of the circulation; the pressure, velocity, and movement of the blood itself, and its changes of color and constitution. While the temperature of the blood is to be ascertained by the thermometer like that of any other fluid, the gases absorbed and exhaled are analyzed. The correct interpretation of these phenomena requires a complete knowledge of anatomy down to the minutest microscopic structures, and the same thing may be said of

organic chemistry, so far as relates to the immediate composition of the animal solids and fluids.

But all such experiments and investigations referred to are to be performed upon the living body, since it is in the living body alone that the necessary conditions of the vital phenomena may exist, even those of the simplest character. Modern physiology still retains the ancient division of vital phenomena into those of vegetable and those of animal life. The vegetative functions are recognized as those which are common to both the animal and vegetable kingdom, while the animal functions consist in the phenomena of sensation, consciousness, intelligence, of voluntary or excited motion—all, in fact, which bring the animal in relation to the external world through the agency of the nervous system.

As a branch of modern medicine, we are indebted to biologists for the discovery of the *physical basis of life*, or to the supposed original substance from which all living beings are developed, and which is the universal concomitant of every phenomena of life. It is now conceded, by the leading representatives of this department of knowledge, that every manifestation of life is caused by corporeal organs which either themselves consist of *protoplasm*, or have been developed out of it. "*In other words, wherever nutrition and propagation, motion and sensation, exist, there is, as their natural basis, this substance designated in a general sense as protoplasm.*"

In eggs and seeds are the basis of life, but the vital properties exist in a dormant state; but, even presupposing the existence of organized structure, it is impossible to give a precise definition of life. The ancients held that there was an independent entity or vital principle, whose union with the body causes life, and its separation from it death.

From the most remote periods in the history of medicine the problem of life has ever baffled solution, even by its wisest investigators, and has in all ages proved the most puzzling question which the human mind has ever attempted to explain. Various modern definitions of life, however, have been attempted. According to Bichat, "life is the sum-total of the functions which resist death." Treviranus makes it "the constant uniformity of phenomena with diversity of external influences," and Beclard calls it "organization in action."

In the light of present knowledge, the celebrated definition of Bichat is insufficient and inaccurate, as the opposition or contrariety between life and death upon which it is predicated does not exist. It is now known that in every living substance destructive processes are simultaneous with constructive or organizing, and in this elemental strife the one process is as essential as the other. The absolute dependence of all the vital processes on oxygenation is now fully recognized. "Life for ever swings between limits of chemical analysis and synthesis. Oxygen eats into and breaks down the complex molecules of protoplasm; nutrition rebuilds those molecules (nutrition, in fact, is simply organic chemical affinity). Nutrition locks up energy in the molecules produced." By oxygenation the stored-up energies of the body are set free and used in organic function. This is perhaps the highest view of the ultimate condition of life which inductive science yet offers, and has been concisely expressed in the definition of De Blainville: "Life is a double internal movement of composition and decomposition, at the same time general and continuous." In accordance with the most recent biological and pathological research, life and health and disease and death may be briefly defined as follows: Protoplasm is the physical basis of life. Chemical force is the cause of life. Organization, function, and decomposition are the effects of life. *Thus it may be said that chemical force, acting upon protoplasm, resulting in organization, function, and decomposition, not only constitutes life, but the harmonious interaction of these conditions, as applied to the physiological elements of the body, likewise represent health; while a perversion or variation of either of these factors as to quantity or condition constitute disease or death, according to the degree of perturbation or alteration which may be established.*

One of the most important steps in the progress of medicine within the last generation is in a more definite explanation of the influence, or rationale, of predisposing, exciting, and determining causes of disease, and in the attempt to define the origin, development, progress, and transmission of *infectious* or *contagious* diseases by means of living germinal cells, normal to and evolved from the animal body itself, and which, so far as facts of growth, movement, and proliferation are concerned, correspond in power and properties with the lymphoid cells, or white corpuscles of the blood, and which may, in fact, be considered as identical with these bodies. The published microscopical demonstrations and investigations of Beale, Sanderson, Bastian, Richardson, and others, having, in fact, rendered this the most reasonable and conclusive of all the so-called "germ" theories hitherto promulgated for the elucidation of the etiology and pathogenesis of this class of maladies, *recent speculation and the alleged discoveries as to the origin of certain specific diseases in certain minute vegetable organisms is still unproved, and thus far has led only to visionary and impracticable measures of treatment.* And in this connection it is fair to state that, while the theory of the microphytic origin of specific diseases has met with a wide-spread popularity, it promises to be of brief duration. It has failed to meet the indorsement of many of the leading medical men throughout the world, and, in fact, an earnest skepticism prevails among many prominent medical scientists as to the real significance of micrococci, bacilli, etc. Their existence in the blood at the outset of disease is denied. Their development a few hours after death is conceded, but their appearance is considered as the result of decomposition, showing nothing as regards the specificity of constitutional infectious disease. The bacillus tuberculosis of Koch, to which so much importance has recently been attached, *is fast losing its diagnostic and prognostic significance*, as it has been found in the non-tuberculous, affected with bronchitis, pneumonia, etc., and shows nothing as regards the specificity of the disease. The discovery of the part played by animal or vegetable parasitic organisms in the etiology of certain *local* diseases is fully recognized; but this analogous explanation of the origin, development, and transmission of *constitutional* infectious disease is to be rejected.

"The search for the explanation of diseased states in modified cell-life is one of the greatest steps ever made toward the establishment of medicine on a scientific basis. If the study of morbid anatomy received an immense impetus from the labors of Bichat, the science of histology has been almost created since his day. The simple, rude lens of Leuwenhoeck and Malpighi has been gradually evolved into the compound microscope, which has, in our day, revealed the cellular structure of all organic animal and vegetable tissue. In consequence of this, we have the development of histology on the basis of the cellular doctrine. And to the adoption of Virchow's doctrine of cell-growth a large proportion of recent progress in pathology is to be directly or indirectly traced. It is plain that, if we are to understand disease, we must understand the vital properties of the tissues in health, and under conditions of derangement. It is now possible to localize morbid lesions in special tissues, and the autopsy, for the first time in the history of medicine, becomes fruitful in useful results. We can now complete the natural history of disease (founded by the school of Hippocrates) by the pathological lesion. In the light of Virchow's doctrine of cell-growth, pathological anatomy has been studied as affording an efficient explanation of many morbid processes. The structure of the tissues and organs in which disease prevails has been exposed, and a distinct structural basis has been given to our knowledge, if not of the disease itself, of the morphological result of the disease. By its aid new light has been thrown upon the chemical recognition of particular forms of disease. Morbid processes, symptomatically indistinguishable but pathologically distinct, may now be discriminated and individualized. Specific varieties of the same type of disease have been recognized from their commencement, and distinguished throughout their course. Constant phenomena,

previously remarked, have been elucidated; large and important classes of morbid processes, before hardly recognized, have been demonstrated; the processes of every disease have been investigated, with general increase of knowledge; prognosis has been given with more certainty and definiteness, and it has been possible to make an exact interpretation of the morbid signs observed. Great and important in itself and its influence on biology, the doctrine of cell-growth has almost revolutionized pathological study." Until the adoption of cellular pathology, as taught by Virchow, the humoral pathologists expressed the idea that the blood was the seat, "almost without exception," of all general diseases, and, further, since purely local disease was considered to be exceptional, the vast majority of diseases were classed under the head of blood diseases. "The healthy condition of the blood was considered by the humoralists to depend upon the normal mixture of its constituents (the *crasis*), and prominent among its constituents were reckoned the germinal substance of the different tissues (*blastemata*), which exuded, through the capillary walls, in the process of nutrition. When the blood-crasis was disordered or diseased, a dyscrasis was said to exist, and dyscrases were held to be, in the majority of cases, primary, though it was allowed that local anomalies of nutrition might, and did occasionally, occur and give rise to secondary dyscrases. A blood disease, or dyscrasis, being established, all morbid changes throughout the body were believed to be but local manifestations of the same." If, however, we accept Virchow's doctrine of *cellular pathology* in its entirety we must believe that the blood is, in every relation, a dependent and not an independent fluid, and that the sources from which it is sustained and restored, and the exciting causes of the changes that it may suffer, lie without and not within it. Substances may enter the blood and affect the corpuscles injuriously; the blood may act as a medium in conveying to the organs noxious material that has reached it from various sources; or its elements may be imperfectly restored; but there is never any dyscrasis or affection of the blood itself which is permanent, unless new influences arise and act upon the blood through some channel or through some organ.

At the present time, while it can not be said that humoralism is professed by many pathologists, the notion of blood disease as generally entertained thirty years ago still clings to the nomenclature and pervades some of our pathological doctrines. Diseases that affect the whole economy—such as syphilis, scrofula, tuberculosis, rheumatism, cancer, and the essential fevers—are frequently described as "constitutional," or blood diseases. Whether their general manifestations are secondary to local disease, as in syphilis and cancer, or referable to inheritance, they are no doubt dependent upon morbid conditions of blood for their development. *Morbid conditions of the blood* as applied to pathological states of the vital fluid are real and numerous, and their association with the development of constitutional disease can be distinctly demonstrated by physical, chemical, or histological examination.

The system of Virchow, which attempts to explain *all morbid processes* by reference to the independent life of cells, their active properties, their proliferation, and their degeneration, while it ignores or attaches less importance to derangements of the circulation, or to alterations in the composition of the blood in the light of present pathological investigation, can not be accepted. It is true that cellular pathology explains many facts which were before obscure, and the important steps thus taken are not likely to be retraced; but, in several points, modification of Virchow's views has become necessary. As to the origin of new growths it is not now held that all arise or can arise from connective tissue. The origin, development, progress, and transmission of constitutional infectious diseases involve a primary morbid condition of the blood, and even in inflammation it is now agreed that the changes of the tissues, however well established, are only of subordinate importance as compared with those depending upon the circulation. Since the days of Bichat the elementary tissues of the corporeal mech

anism have been still further reduced, instead of twenty-one then designated. Leydig, by bringing to the investigation the aid of the microscope, *has reduced them all to four*, which are the fundamental tissue elements, viz.: the *nervous*, the *muscular*, the *connective-tissue element*, and the *cell element* (i. e., epithelium, blood-globules, glands). Upon this basis the localization of all morbid lesions is now possible. "But the study of pathological conditions relating to any one of these elementary divisions, wide as it may be, is not safe unless with frequent reference to the others for their aid; and every study of diseases of one part or of one kind is very unsafe unless with constant recognition of its narrowness and partiality. Even if it could be made sure that many diseases begin in morbid states of the blood or nervous system, or any other chief constituent of the body, it would be nearly as sure that within a few hours, or even minutes, of their beginning the other chief constituents would be involved. For the relations of the several parts are so intimate, and, through the nervous system and the circulating blood, their means of communication are so swift, that, if one be diseased, none can long remain healthy. '*There is no truth more necessary to be held in pathology and in its practical applications than that the health of each part is a necessary condition of the health of all the rest.*'" "In recognition of this principle, a tendency has been manifested of late years to supplement the analytical method of pathological investigation (which, however useful and necessary, had been carried to an extreme, and had caused the direction of too great a degree of attention to details and single symptoms) with a synthetic or constructive method. Under the latter method a disposition has arisen to regard disease in a broader and more comprehensive manner; to view more prominently the relation of morbid tissues and functions to the organism generally; to emphasize less the variations than the constitutional form of the disease; to recognize in some way or another not only the so-called vital forces, but the indefinable "life" which is hardly known in pathological anatomy. Under the synthetical spirit '*the study of the ancient doctrine of humoral pathology, which seeks for the causes of disease or of its first effects in the blood or fluids of the body, has been revived.*'" The recent microscopic investigations and discoveries of Cohnheim and others have greatly contributed to the latter result. "By the establishment of a common basis of elementary morbid lesions occurring in every part of the body, the same morbid processes are seen to take place in different structures of the body, with primarily the same effects, which are modified only by the function and character of the tissue of the part involved. The abnormal increase of connective tissue in the structure of any organ, for instance, ends in contraction, compression, and obliteration of the structural elements, with consequent loss of function. Inflammation, occurring in any tissue, leads to effusion, extravasation, and suppuration. All the elementary processes of pathology may be seen in different tissues and organs producing the same effects, only that the effects are manifested in a manner peculiar to each part; with the same fundamental lesion the disease is the same essentially, although wholly distinct in appearance. Since the vast majority of diseases can be resolved into these fundamental processes, a scientific and durable foundation for pathology is now established which is of the highest value and significance for philosophical medicine. Under this view, diseases of different organs, which, until their essential elements were demonstrated, appeared to have nothing in common, are now seen to be results of the same process. *Thus a great tendency among medical investigators throughout the world may be observed at work toward the codification and unification of disease and the resolution of complex forms into the simplest elements.*"

Illustrations of the progress that has been made in the scientific and laborious study of forms of disease are afforded in the case of nervous disorders which are now traced to general changes taking place in other parts of the system; and those processes have been connected with certain signs by which they are recognized clinically. Even in psychological medicine insanity has been demonstrated to be the result of definite cell-change. Mind

is now regarded as a phase of force. The inseparability of matter and force is now fully recognized. From the irritability of protoplasm up through reflex action, instinct, memory, reason, and will, the amount of mentality is in direct proportion to the clustered nerve-cells and their structural integrity. The occult mysteries of mental aberration are now studied through the malnutrition of nerve-centers. It is now conceded that reason is as much dependent upon an abundant supply of rich oxygenated blood as any other function of the body.

The clinical history of other so-called local diseases corresponding with the different physiological systems—namely, the respiratory, circulatory, digestive, and genito-urinary—have also been greatly perfected within the present generation. For this, modern medicine is under the greatest obligation to the fifty years' experience of Professor Austin Flint, as a clinical observer and teacher, and the published results of his formulated views. And some progress can also be claimed in our knowledge of the essential fevers and other general diseases of the system. The nosological division of essential fevers into the periodical, continued, and eruptive is still retained; but an important fact now recognized is that these fevers may be blended; that physicians have to deal sometimes with two fevers combined; that a continued and periodical fever may exist in combination, e. g., *typho-malarial;* that a continued and eruptive fever, as *diphtheria* and *scarlatina*, may coexist; and that two eruptive fevers, as *rubeola* and *scarlatina*, may concur. The Hunterian doctrine that two general diseases can not be united has been abundantly disproved by modern clinical observation. The rationale of fever and the correlation of the pathological condition to "waste" products of the system, both as to cause and effect, is now more clearly comprehended. Among what is termed general diseases of the system, morbid conditions of the blood elements have received certain and definite explanations. The correlation of *syphilis*, *scrofula*, and *tuberculosis* has, since the days of Lugol, been more clearly traced. And the dependence of such diseases upon *morbid conditions of blood-cell elements* has been almost positively demonstrated. *Gout* and *diabetes* have been elucidated in their chemical results, and have been studied as a question of physiology rather than from a pathological standpoint, while of such diseases as *tetanus* and *chlorosis* something more definite is known than the descriptions of Hippocrates tell.

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The study of disease by the methods of investigation represented by the stethoscope, laryngoscope, ophthalmoscope, and by urinoscopy and other instruments of scientific precision, has been elaborated and formulated to an extent undreamed of by the authors of such methods. Through them a certainty and precision are afforded to certain signs which must in all cases be inquired into, but which, before the use of such means, were most vague and indefinable. Recent progress in this direction, as well as in pathological anatomy, has been largely due to microscopic study. Substantial and important aid has also been given by chemical analysis of the ultimate results of morbid processes. Electricity also has been made to contribute materially to the more precise determination of the general effects and conditions of disease, while other means of smaller and more limited scope have assisted to build up a broad basis of semeiology, which is of the utmost value, because it supplies a positive estimate of the vital powers and the constitutional relations of local disease that are fundamental factors in every case, and which could otherwise only be vaguely guessed.

By means of animal experimentation and vivisection, physicians and surgeons have, of late years, gained knowledge concerning the relation of the various organs of the body and their affections, the value of which is beyond estimation.

"The most important step in therapeutics, and probably the most important in the whole history of this branch of medical science, consists in the recent adoption of a definite physiological aim in the use of remedial measures; of the practice of administering medicines with a definite purpose to produce a distinct physiological effect, instead of employing particular drugs with a vague idea that general favorable results have followed their use. *This principle is the necessary result of the clearer definition of disease and of the action of drugs.*" When the aggregate symptoms presented by a disease were analyzed, one generally assumed a causal relation to the others which singled it out as the object of therapeutical attack. Or, again, the urgency of certain symptoms, or the irremediable character of the essential lesions rendering other treatment of no avail, gives a purely symptomatic aim to the whole plan of treatment. The principle of this method is that no true progress in therapeutics can be made if more than one drug is employed, and was antagonistic to the polypharmacy so much in vogue by our predecessors in which a favorable result could not be attributed to any single drug. The basis of this principle, therefore, is that only a single drug is to be administered for a single intention, and where no definite therapeutic indication can be observed no drug is to be used. This is the modern justification of "expectant" treatment. "*But disease is seldom a single pathological condition, with a single essential symptom, which a single remedy can relieve.*" If, however, we are certain of the action of a single drug, and that this action alone is sufficient or desirable, it is best given uncombined, in order that its effects may not be antagonized. In all other cases, however, the absurd "*law of the single remedy*" is relegated to homœopathy. The most recent tendency of therapeutics, therefore, is with reference to a clear insight as to the "synergetic" action of drugs. The modern therapeutist now recognizes the fact that by a judicious combination of drugs acting in the same direction we get better and more satisfactory results than from either of them given alone. And that in this way their action is not only increased, but modified to suit different indications, which is not always possible by the use of a single drug, however well selected as to character or dose. The physiological antagonism of drugs, recently studied, often leads to the combination of two or more drugs, of diverse properties in order to counteract some unpleasant physiological effect. It is for these and other reasons that the latest tendency in therapeutics is to revert cautiously and partially to the

combination of remedies, *still following pathological indications, but not submitting the whole plan of treatment to a single dominant symptom.* And, in fact, the so-called *pathogenetic* treatment is, as far as can be, taking the place of the symptomatic. This tendency may be plausibly referred to the more constructive or synthetic disposition which of late seems to be almost a governing principle of medicine. "It may be illustrated in the modern treatment of consumption, in which, in place of the sedative treatment that sent patients to a warm, moist, relaxing climate, a stimulating and bracing plan of open-air life has been adopted. The former method was the treatment of *symptoms*—that is, of the cough; the latter is the treatment of the essential disease by improving the constitutional powers and condition." There can be no doubt of the value of the one-drug treatment of certain conditions of disease, nor that it is strictly scientific and has largely contributed to the advance of therapeutics. It is essentially the definite basis of therapeutics, and, in appropriate cases,gives the chief successes of medicine. "*But where disease is a complex condition, the treatment must also be complex;* and, even where a single cause can be defined, its effects and results give to the affection a complex character. The essential aim of therapeutics may be stated as being the induction of a physiological process for the remedy of disease. The more nearly this induced process assumes a definite chemical or dynamic form, the more positive and direct is the action; and recent advance has greatly aided the statement of many therapeutical problems in chemical or mechanical terms." At the same time the influence of the nervous system is so constant and direct in every process of the body that these problems must always be distinctly physiological, and can not be stated as purely chemical or mechanical unless the correlation of the so-called vital and physical forces is acknowledged. "The nervous element is, however, neutralized, as an interrupting element in many cases, by its very constancy, by reason of which it is present alike on either side of the equation, both in cause and effect." But if therapeutics has been thus simplified in one direction, it has made use of more complicated physiological processes in another direction. Some of its most certain and remarkable effects are obtained by acting upon the nerve-centers in the brain and spinal cord by which these effects are nominally induced. Still more striking than the use of drugs in this connection are the results obtained by the precisely localized and measured action of heat and cold upon the central nervous system. "In these various ways nervous influence is contracted or subordinated in place of disturbing the therapeutic plans."

In modern medicine, the importance of a more careful study and complete understanding of a somewhat limited number of remedial agents, in place of an incomplete knowledge of the long list of drugs that go to make up our Materia Medica, is recognized as tending to greater precision in therapeutics.

"The old and tried method in therapeutics is that of empiricism or clinical experience. The best possible development of this plan of investigating and treating disease is to be found in a close and careful analysis of cases before and after the administration of a remedy, and, if the results be favorable, the continued use of the drug in similar cases." That very much has been accomplished in this way is universally admitted. In fact, if we leave out of sight the growth of the last quarter of a century, almost all of the therapeutic knowledge has been obtained in this manner. But the revolutions, contradictions, and therapeutic discord of the past have induced the representatives of modern medicine to question the old methods, and to seek further progress in exact physiological experimentation, in order that therapeutics may be raised from the position of an empirical art to the dignity of applied science or rational basis governed by law. *When the physician is confronted by disease, the first effort is to discover what is to be done, and the next what are the means at hand.* "Through the advances made by pathologists and by the students of the natural history of disease, we are fast learning the methods by which nature brings the body back to health. When this is done—when disease is thoroughly understood—we shall have solved the first ele-

ment of the problem, shall have complied with the first requirement of the law. But the work of the therapeutist is chiefly with the second portion of the law. Evidently it is his especial province to find out what are the means at command; *what the individual drugs in use do when put into a human system.* It is seemingly self-evident that the physiological action of a remedy can never be made by a study of its use in disease." The new and ever-varying factors of the effects of disease and its natural vibrations on the system renders the problem so complex that it could never be elucidated from this stand-point. And if the human family are none too anxious to receive medicine when affected by disease, they are still less so when in health; and, if they were not, human life is too precious for scientific experiment with drugs of unknown quality or potency. It is for these reasons that experimentation upon lower animals, and applying the results thus obtained by analogy, is fraught with such important results in the application of drugs to the treatment of disease. When the laws which govern the susceptibility of animals to different drugs which are based upon their difference of organization are fully developed, the value of such experimentation in giving a definiteness and certainty to therapeutics must be recognized as of the highest importance. And, in fact, the sedulous and laborious investigations in this direction by such men as Boehm, Meyer, Ackermann, and Traube, of Germany; of Paul Lorrain, Claude Bernard, Brown-Séquard, and Legroux, of France; of Fothergill, Foster, and Lauder Brunton, of England, and of H. C. Wood, Bartholow, Ott, Hammond, and others in the United States and other parts of the world—are to be recognized as doing more in placing the domain of therapeutics upon a strictly scientific foundation than any other influence in its former history.

"The growing identification of therapeutics with physiology is also seen in the hygienic treatment of disease. Not only are hygienic measures used for general purposes of advantage, but distinct applications of hygiene are employed for a distinct physiological effect. Schemes of dietetics, for instance, are not only used with negative precautionary aims, but with positive remedial intentions. By the prevalence of certain climatic conditions, natural or artificial, physiological states of the body are induced, and may be calculated upon as distinctly curative. Exercise may be so ordered that particular secretions and processes shall be stimulated, while others are unaffected. This mode of treatment has largely displaced the use of drugs, and has greatly diminished the expectation of specifics, if not the desire for them. Improvement in the methods of treatment of the insane has been manifested in the discarding of the system of mechanical restraint and the substitution of judicious mental control in public as well as private institutions established for their cure. A great power has always been recognized in the enlightened practice of hydropathy; but it can not be said that its therapeutic function has as yet been definitely established. Excellent results have been obtained in the application of gymnastics for its decided remedial value in particular affections, as well as, and quite distinct from its beneficial effect, exercise, and in the culture of the physical powers. Many nervous and muscular disorders, in which the main defect seems to be in the controlling power of the brain, are certainly benefited by such treatment; and the brain can often be thus educated so as to establish a normal functional action in the place of one that is aberrant or altogether wanting."

"The relation of electricity and disease has been well investigated; a precise code of electro-therapeutics has been established, and clear results of considerable value have been obtained; *but it can not be said that electricity has been as successfully applied for remedial as for diagnostic purposes,* and a feeling of disappointment in regard to its influence on disease has been produced."

The advance of chemistry has produced some new remedies of impor-ance, which have not, however, been derived from the organic side of sci-ice. No connection has been traced between the chemical composition of e essential principle of a secretion and a chemical remedy; and whil

chemical stimulants and depressants have been demonstrated for every organ, their action has not been explained by any law of chemical or physical constitution. *The rule established by Rabuteau, that the therapeutic energy of soluble metallic salts is in direct ratio with the atomic weight of the metal contained in the salt*, suggests probabilities of the enunciation of such laws in the future.

"The isolation of the active principle of a drug is a decided approximation to scientific precision; but the clinical gain from this source is not always certain, for the entire drug is often seen to act with more advantage than the simple alkaloid, even though the alkaloid is practically the therapeutic power of the drug. It is not yet clear whether this difference is due to the chemical or molecular condition in which the active principle is present in the plant, or to the modifying influence of other slightly powerful substances. The vegetable kingdom has supplied the great bulk of the recent additions to the list of drugs, and chemistry has given some most important remedies; but the animal kingdom, where many favorite remedies were formerly found, is now hardly regarded."

Important advance has been made in the principles of the administration of drugs, especially in regard to their application to the part they are designed to affect as directly as possible. By the subcutaneous injection of the active principle of drugs the effect is more localized, and less constitutional disturbance is produced than when the administration is by the mouth. Medicine can be employed this way not only with more accuracy, but, entering sooner into the general circulation, it acts more quickly, while the risk of decomposition before absorption which is incurred by mixture with the digestive fluids is avoided. The method of direct application is also exemplified in the inhalation of suitable substances by means of "atomization," or the spray apparatus. But so much doubt has been cast by physiology upon the absorbing power of the skin that external treatment by lotions and ointments has been greatly restricted, though local and constitutional effects are obtained by means of suppositories and soluble medicated gelatine bougies, especially in rectal and genito-urinary disease.

Special study has been given to the employment of anæsthetics. A considerable number of substances have been used more or less extensively, and their physiological effects have been closely compared. A smaller quantity of the inhalent has been found sufficient, and happier results (in view of the slight danger to life incurred in ordinary inhalations) have been obtained by the method of "mixed narcosis," or the administration of alcoholic stimulants, or the subcutaneous injection of narcotics before the use of the inhalent. The more correct principle of local anæsthetization, in which the disturbance of the system is avoided, has been successfully adopted in the application of the freezing effect of the ether-spray of Richardson, or the "Rhigolene" of Bigelow. "*The physical and mental quietude induced by inhalation must, however, always keep a place for it in appropriate cases.*"

One of the most striking features of contrast between modern and ancient medicine relates to the almost entire disuse of the lancet. The art of general bleeding, practiced for centuries more or less universally, has, within the last few decades, fallen into almost complete disfavor. "No doubt several causes have contributed to this result, such as a better knowledge of the nature of disease, teaching us that its processes were frequently of a lowering or depressing character, which were to be overcome not by the abstraction of blood, but rather by the use of stimulants and support." In such cases, if antiphlogistic measures were adopted, they proved failures, and taught the physician that blood-letting was not the universal panacea it was supposed to be. By degrees it ceased to be practiced as it used to be. A new generation, which knew not the past, has sprung up; *and as, in all reactionary movements, the pendulum of popular opinion, swayed by caprice and fashion, has swung from one extreme to the other, and the practice of venesection, which is sometimes the most potent and valuable of therapeutic agenci has become at length as limited as it formerly was universal.* It is aln

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certain that in either extreme there is an evil, and that we may yet have recourse, in certain cases, to abstraction of blood with some degree of that success which formerly led to its extensive use, if not to its abuse.

Although prevalent fashion has blinded the medical profession to the inutility of blood-letting, and the use of the lancet has gradually become a "lost art," there can be no reasonable doubt but this was a step backward, instead of forward, in medical progress, and that the result has been a hindrance to medical science. It is now known that stimulation—the new idol which the professional mind has set up to worship in place of venesection—is often used to an extreme in practice, "*and that over-stimulation is just as inappropriate in the formative stage of a disease as was blood-letting when it had once matured.*"

"It would have been far better for modern medicine if, instead of absolute discardment, a system of reform in the use of the lancet had been instituted. There can be no question but what we occasionally meet with some instance of severe inflammation in almost any organ of the body that has produced death, or, at best, led to slow and most painful convalescence, that could have been benefited, and possibly cured, by a timely abstraction of blood, drawn in such manner and in such quantity that, in any circumstances, the patient could not have been injured by its withdrawal."

It may be reasonably conceded that the abstraction of a limited quantity of blood has no deleterious effect upon the healthy organism, and that, in many diseases and conditions of the system, it may be most suitably and beneficially employed. And, indeed, it is now held to be certain, by many of the most skilled and judicious practitioners of medicine, "that for some special morbid conditions, either with or without inflammation, venesection is a potent and life-preserving remedy; that there are many exigencies for which it is not only safe to employ, but unsafe and unpardonable to withhold it, as many a blind eye, deformed limb, and premature death might well testify." Broadly stated, bleeding is indicated now, as it has always been, where there is evidence of marked over-distention either of the arterial or of the venous system. In either case the result will be cardiac distention of the left or right chambers of the heart, respectively. In such cases the utility of blood-letting, by restoring the lost equilibrium of the vascular system, with relief to the heart and other parts concerned in the circulation of the blood, admits of no question. In the congestive form of apoplexy, puerperal eclampsia, and amenorrhœa especially, the congestive form occurring at the climacteric period, pulmonary œdema, acute laryngitis, and in acute inflammatory rheumatism of robust or plethoric subjects, in acute sthenic peritonitis, pleuritis, acute iritis, uræmic convulsions, or coma, and in insolation—blood-letting is often, when judiciously employed, the most valuable measure of relief; while other affections might be mentioned in which this agency still seems to be more or less indicated. This is especially true of pneumonia; but in this disease, as in others, it is most useful in the early stages. It is indicated in otherwise healthy patients suffering from the acute and sthenic form of the disease, if resorted to sufficiently early. In such cases it relieves pain, cardiac embarrassment, abates the fever, and, if it does not arrest the disease, it certainly appears to shorten its duration.

Past experience and present physiological and pathological investigation has, however, taught the representatives of modern medicine that venesection is distinctly contra-indicated in all forms of adynamic disease, and even in those mentioned when evidence of great depression exists; and that the very young, the old, the feeble, and the cachectic do not bear well the loss of much blood. This consideration does not render the topical abstraction of blood by means of leeching, scarifying, and cupping inadmissible when such persons are attacked by dangerous inflammation; but it especially enforces the golden rule that no more blood should be abstracted by such agencies than seems absolutely requisite to control the disease.

The antipyretic treatment of diseases, characterized by excessive temperature, by means of cold baths, and with drugs which appear to antagonize the

febrile process by diminishing heat production, are therapeutic measures of modern origin; but their efficiency is by no means universally admitted.

This method has been adopted by many on the supposition that in certain maladies the *hyperpyrexia is the sole evil;* and, with this view, they have been largely employed in typhoid fever. In this disease, it is claimed by the advocates of cold baths that the symptoms are abated and the mortality is reduced. "If this were so," says Professor Alfred Stillé, "the method would become popular; but the fact remains that baths are not much favored outside of Germany, and by no means generally there. The high temperature is considered the evil, *while, in reality, it is only a symptom of the disease,* and never rises so high as of itself to necessitate active cold baths. The value of cold baths lies not in the reduction of temperature, but in the diaphoresis which they produce, eliminating the poison. The cold bath, with quinine and digitalis, has been said to reduce the mortality from this disease from 27 per cent to 8 per cent. But this boasted result shows only the advantage of this treatment over the old heroic treatment of venesection and purgation. It makes but a poor showing beside the result of the supporting treatment, with no drugs whatever, the mortality of which, in London, Paris, and this country, is *less than 5 per cent.* The treatment by cold water, quinine, and digitalis has been abandoned in the Vienna hospitals, where the mortality was 19 per cent to 25 per cent. Liebermeister announced that by it '*the proportion of relapses and the mortality are increased.*' Others attribute to cold water the increase of hæmorrhage, neuralgia, and pain in the limbs. But Liebermeister now admits that the nervous and all other symptoms are relieved and ulcers prevented by cold water. The treatment by cold water is, probably, of value when employed persistently." According to the views of Professor Austin Flint, cold water may be applied by means of the bath-tub, sponge-bath, and wet sheet with sprinkling, as often as the temperature rises in the axilla above 103°, and continued sufficiently long for the reduction of temperature to 101° or lower, without risk of any immediate injury; and that the study cf the cases under his observation furnish no ground for supposing that a liability to complications or accidents is thereby increased, and reduction of temperature by these modes improves the condition of the patient. But "*the cases he has studied do not afford proof either that the fatality of typhoid fever or that its duration is thereby diminished.*" Professor William Pepper restricts the use of cold baths to the first ten days in cases where the temperature runs above 103° *and can not be controlled by milder measures.* Professor Alfred L. Loomis employs the wet pack in cases too weak to be put in the bath, "*and regards cold baths as contra-indicated by feebleness of the heart's action.*" Professor Alonzo Clark says, "in young persons, the cold bath is the most convenient and efficient means of reducing temperature, and that the temperature of the bath should be just 10° below the temperature of the patient's body." The conjoined use of cold baths and antipyretic doses of quinine and digitalis and veratrine is a plan of treatment which is regarded in much the same light. It has been characterized "*as a battledoor and shuttlecock treatment, in which the patient is kept continually oscillating between a state of incipient reaction and the verge of collapse.*" The method of using quinine is to give fifteen to forty-five grains in the evening, and its effect then is to reduce the temperature and keep it down for twenty-four to forty-eight hours. It is repeated again when the temperature rises. The direct antipyretic effect of quinine is greater than that of cold water. Professor Roberts Bartholow thinks it is useful in typho-malarial fever in direct proportion as the malarial element predominates, but that in typhoid fever his own experience and observation have convinced him of its inutility. In this disease it not only exercises no control over the course and duration of the disease, but, as a rule, the delirium, the cephalalgia, the diarrhœa, and the dryness of the tongue are increased by its use, while its inhibitory influence upon the heart and paralyzing effect upon the nerves of organic life renders it a dangerous remedy in toxic doses. Peacock, of London, and Niemeyer, of Germany, have both given up the use of large

of quinine. Stillé holds that quinine in large doses is unnecessary, useless, and often dangerous, and that it *may kill the patient by paralyzing the heart.*

"*The results of the treatment of typhoid-fever patients at Bellevue Hospital within the past ten years have shown that large doses of quinine, and that the antipyretic treatment by cold baths, are unnecessary, and that the employment of mineral acids and of symptomatic remedies is sufficient.*" ("The Medical Record," December 1, 1883, p. 596.) It is evident that, while such views as the above are entertained by representative medical men throughout the world, the so-called antipyretic treatment can never become popular in the management of typhoid fever; and since it exercises no control over the course of the disease, and most probably increases or prolongs its duration, while the perturbation thus induced may add greatly to the danger, at least in this affection, its employment should be restricted to rare and desperate cases, in which milder measures in therapeutics prove unavailing. In other diseases, however, which are less adynamic and characterized by excessive temperature, its utility is more conspicuous. This is especially true of acute sthenic pneumonia, severe erysipelas, scarlatina, and other affections in which the hyperpyrexic temperature appears to be the chief danger; but even in these maladies *such treatment must be regarded as symptomatic rather than pathogenetic.* But whatever objections may be otherwise raised against the use of antipyretic drugs, they certainly have the merit of scientific precision, as by their use we are enabled to bring about definite results—that is, prompt reduction of excessive body-heat; and if this be the chief factor in the production of parenchymatous degenerations and other dangerous sequelæ, by its control they may sometimes exercise a life-saving influence; and if those results may not be so certainly or so conveniently attained by other means, antipyretic measures should be recognized as holding an important position in modern therapeutics when employed with judgment and discrimination upon the part of the physician.

"Whether all putrefactive processes in wounds and the dissemination of contagious or infectious diseases are caused by the development of living organisms, as is generally believed, or partly result from other poisonous agencies, concerning which some difference of opinion may still exist, a substantial agreement prevails that the use of antiseptics renders innocuous certain poisonous matters which are met with in such cases; though the effect is practically the same, if strict cleanliness is enforced and the purification of the air is attained by thorough sanitary measures."

In summarizing the present condition of medical science and practice, it may be said that the tendency of "modern" medicine has been constructive or synthetic, and at the present time this is in especial contrast with the infinitesimally analytic spirit of its earlier years. In pathology the generality of diseases have been reduced to a basis of elementary morbid lesions, modified only by the function and structure of the organ and parts of the body in which they appear. In semeiology, the measurement of the extent of impairment of the vital processes supplies the basis for a definite estimate of every case of disease. In therapeutics, since pathology is becoming better understood, the principles of these two departments of medicine are more harmonized. And pathogenetic or general constitutional treatment increasingly supplants the symptomatic, or the tinkering of one or two symptoms only; and when the affection can be resolved into a single radical symptom the remedy often attains the positiveness and completeness of a physiological demonstration, while still broader principles of hygiene, governed by increased knowledge of the causation of disease, and a just conception of the *vis medicatrix naturæ*, frequently supersede entirely all other therapeutic measures. Modern medicine recognizes more and more that its care is for health as well as for disease, to prevent as well as to cure, and, observing that the beginnings of disease are often in more or less violation of the conditions of health, seeks to prevent these violations.

Recognizing also that the health of communities, and even of nations, often pends upon the health of individuals, the representatives of modern medi-

cine, with an unselfish devotion to public interest, seek to inculcate among "the laity" all knowledge that experience and observation have taught with respect to personal and domestic hygiene, in order that the greatest good may result to the greatest number. Under this policy, results of the most striking and important character have always been obtained in what is termed public hygiene. Even by the rudimentary practice of sanitation, which as yet alone obtains, the most terrible forms of disease have been banished. The *plague* and *leprosy* have practically disappeared in every civilized country, and other diseases have assumed a much milder form. With more efficient sanitary measures the so-called *zymotic* and *specific forms of disease* which have so scourged the world will become more and more rare, if they do not altogether disappear.

PART I.

GENERAL PATHOLOGY.

PRELIMINARY OBSERVATIONS.

Medicine, in its broadest significance, embraces all subjects having reference to health as well as everything pertaining to the knowledge and cure of disease. In this sense it includes anatomy, physiology, chemistry, materia medica, pathology, hygiene, and therapeutics. The present treatise will be especially devoted to a general consideration of that portion of pathology, hygiene, and therapeutics belonging to human diseases, and is not intended to embrace within its scope the domain of surgery, or the department known as obstetrics.

Pathology is defined as the science of disease. It embraces a knowledge of the nature, cause, phenomena, and results of morbid conditions. In its more extended range it may also include the consideration of all those agencies which prevent, modify, or remove these departures from health.

As a province of scientific knowledge, this department of medicine has been divided into *general* and *special* pathology. The study of individual diseases constitutes special pathology. On the contrary, there are morbid conditions not peculiar to any individual disease, but are common to a greater or less number of diseases. The study of these conditions constitutes general pathology.

"Inflammation, for example, is a morbid condition which exists in a large number of individual diseases. The study of inflammation as a condition common to different diseases belongs to general pathology, while the study of the individual inflammatory diseases belongs to special pathology. A further illustration is in that morbid condition which enters into a number of individual diseases and known as fever. In this sense of the term, fever belongs to general pathology, but the study of the different forms of fever (or individual fevers) belongs to special pathology. The relation of general to special pathology is analogous to the relation of general to special anatomy, the former describing the several tissues which enter into the composition of the different organs of the body, and the latter describing the particular organs composed of the tissues. As the number of tissues is small in comparison with the number of organs, so the morbid conditions belonging to general pathology are few as compared with the great number of diseases belonging to special pathology." In the following pages the subjects which belong to the principles of medicine or general pathology are presented. "The principles of medicine constitute medical science.' 'The practice of medicine is the exercise of medical art.' 'Science is knowledge reduced to principles; art is knowledge reduced to practice.'

"The subjects of *general pathology*—namely, the morbid condition common to a greater or less number of individual diseases—are to be considered under various points of view; hence this department of knowledge admits of several subdivisions. One point of view relates to *nomenclature*, or the naming of diseases. Another relates to their classification. Another subdivision general pathology relates to the causation of disease. The study of the

causes of disease is called *ætiology*. As belonging to general pathology or the principles of medicine, this branch of medical knowledge should next claim our attention. The next important subdivision of general pathology relates to appreciable morbid changes of the fluids and solids of the body. The study of all changes appreciable by the naked eye or with the aid of the microscope constitutes a branch of pathology of great importance, called *morbid anatomy*. Changes which can not be detected either by the naked eye or by the aid of the microscope, but which require for their detection processes of analysis or the employment of reagents, are usually considered as falling not within the scope of morbid anatomy, but within the domain of animal chemistry. Morbid changes not visible or not yet ascertainable with our present means of observation are distinguished as *functional*, and are also said to be *dynamic*.

"It is probable that in all the so-called functional or dynamic deviations from health there is either molecular or cellular changes; in other words, anatomical changes at present inappreciable, or at all events undiscovered, but which may hereafter come under our field of observation by continued and improved means of investigation. Appreciable anatomical changes are distinguished as *lesions*. The study of the minute anatomy of the tissues and fluids of the body with the microscope is called *histology*, and the term *morbid* or *pathological histology* is sometimes used to designate that part of morbid anatomy relating to those abnormal changes which are the subjects of microscopical research. The study of the origin and development of pathological processes is called *pathogenesis*. Anatomical changes or lesions belong to general pathology in so far as they are common to a greater or less number of individual diseases. It is a fact, however, not to be lost sight of, *that lesions do not constitute, but are the results of, disease*. In other words, they are always due to underlying morbid actions or processes which may not be directly appreciable or well understood, but which in reality constitutes the morbid condition. In fact, we know little or nothing of what constitutes disease; that which we do know consisting of physical changes in the body which are, indeed, the effects of disease, but not disease itself. This fact, although evident, is apt to be overlooked. Lesions are, of course, serious or otherwise, according to their character, their situation, and the amount of structural change involved.

"The great number and variety of phenomena or events to which disease gives rise constitute another subdivision of general pathology. These phenomena or events are called symptoms, and their study constitutes a branch of medical knowledge called *symptomatology*, or *semeiology*. Closely connected with symptomatology is another subdivision of general pathology called *diagnosis*. This subject relates to the discrimination of diseases from each other. The next subdivision which should claim consideration is *prognosis*, or the prediction of the termination of diseases. Lastly, the treatment of diseases is called *therapeutics*. General principles relating to the treatment of disease may be appropriately considered in connection with general pathology. This portion of the subject is distinguished as *general therapeutics*. The subdivisions of general pathology represent also the different points of view under which individual diseases are to be considered; that is, individual diseases as well as the morbid conditions common to a greater or less number of diseases are to be considered in the same order with reference to the morbid changes either of the fluids or solids which they may respectively involve, together with their causes, their symptoms, their discrimination or diagnosis, their prognosis, their prevention, and their treatment."

A full consideration or description of any individual or particular disease would consist of its *definition* or *nomenclature*, its *classification*, and "an account of the causes that give rise to it or its *ætiology;* the changes of structure or of function which constitute it—that is, its *anatomical characters* and *pathology;* the phenomena attending these changes, otherwise the *symptoms* and *signs* of the disease; the facts that serve to distinguish this particular disease from other diseases—that is, its *diagnosis;* the m

of forecasting its progress and termination, which constitute its *prognosis;* and, finally, the measures by which it may be prevented, relieved, or removed—that is, its *treatment.*" *In the first part of this work all of the subdivisions of general pathology are, as far as may be practicable, discussed upon this uniform plan in order that its principles may be applicable to the investigation and treatment of special diseases.*

Definition of Disease.—Disease may be defined as a deviation from the standard of health in any of the functions or component materials of the body. Thus the term may be applied to some simple phenomenon—for example, neuralgia, when that phenomenon is the sole effect of a cause—or it may include many concurrent or consecutive resultant phenomena, such as those of syphilis or typhoid fever.

General Considerations.—"It is well known that changes of function and of structure are brought about and influenced by a great variety of agencies. These agencies, some of which act from within, others from without, are recognized as *causes* of disease. Such changes, whether they be functional, affecting more especially the vital properties of the body, or structural, affecting its physical properties, constitute what is familiarly known as *disease*, which is hence called, respectively, *functional*, or *structural.* These changes are merely the evidence of a perverted action, which is then in operation, or has already occurred, the nature of which is considered under the head of *pathology.* When these deviations from health can be recognized during life, they are described as *symptoms*, or *signs* of disease." As thus understood—and it is well to remember it—*disease* is an abstraction or relation, and not an entity having a special and independent existence.

Nomenclature of Disease.—In all science nomenclature is an object of importance, and each term should convey to the student a definite meaning. The nomenclature of pathology has required the greatest attention; and, although repeated attempts have been made to improve it, the barbarous terms that disgrace it are still frequently adopted. It consists of Hebrew and Arabic terms, Greek and Latin, French, Italian, Spanish, German, English, and even Indian, African, and Mexican, often barbarously and illegitimately compounded. A want of principle in forming the technical terms of medicine is everywhere observable. They have been formed, for example: 1. From *color*—as *melæna*, *melas atrabilis*, *chlorosis*, *rubeola*, *scarlatina*, *purpura*, etc. 2. From *duration*—as *ephemeral*, *quotidian*, *tertian* and *quartan*, *continued* and *intermittent*, etc. 3. From *birds*, *beasts*, *fishes*, *insects*, and *plants*—as *rabies canina*, *cynanche*, *boulimia*, *pica*, *elephantiasis*, *urticaria*, *lichen*, *ichthyosis*, etc. 4. From *persons* or *places*—as *chorea Sancti Viti*, *lepra Arabum*, *sudor Anglicus*, *ignis Sancti Antonii*, *morbus Brightii*, etc.

"The great desideratum in nomenclature, as applied to diseases, is, that the name of each disease shall express the morbid condition involved, and its situation. The names formerly applied to different forms of disease were frequently fanciful; but many of them are still in use, owing to the difficulty and inconvenience of displacing them after their establishment in medical literature, and in not a few instances it is by no means easy, with our existing knowledge of the essential character of morbid conditions, to substitute more appropriate names. Some approach, however, has been made toward a nomenclature which shall measurably secure the advantages derived from this source in other departments of knowledge, more especially of chemistry. The existence of inflammation, which enters into so large a number of individual diseases, is expressed by the suffix *itis* added to the anatomical name of the part affected. Thus bronchitis, pneumonitis, pleuritis, peritonitis, etc., are names denoting the inflammatory character of the diseases to which they refer, and the particular part which is the seat of inflammation. The suffix *œa* denotes the existence of the morbid condition known as transudation, or flux, occurring in a situation where the liquid escapes upon a mucous surface. Examples are entorrhœa, gastrorrhœa, cystorrhœa—terms which have not as yet come sufficiently into use.

"The suffix *rhagia* expresses a flow of blood or hæmorrhage from a mucous

surface. Examples are metrorrhagia, gastrorrhagia, entorrhagia, bronchorrhagia—very appropriate terms, which have, unfortunately, not yet displaced less perfect ones in common use. The suffix *algia* signifies a morbid condition characterized by pain without inflammation. Thus neuralgia is a general term applied to the condition affecting any nerve or nerves; gastralgia, enteralgia, pleuralgia, etc., are terms severally expressing the neuralgic character of the affection and its situation. Words ending in *æmia* are applied to certain morbid conditions of the blood. Examples are anæmia (impoverishment of the blood), uræmia (morbid accumulation of urea in the blood), septicæmia (putrid infection of the blood), and pyæmia (purulent infection of the blood). Words ending in *uria* are applied to certain morbid conditions of the urine. Examples are albuminuria, hæmaturia, oxaluria. The prefix *hydro* denotes a dropsical affection of the part named, as hydrothorax, hydrocephalus, hydroperitonæum, hydropericardium. The prefix *pneumo* denotes the presence of air in the part, as pneumothorax. The name of an inflammatory disease to which *peri* is prefixed signifies inflammation of the membrane investing the part inflamed, and the prefix *para* denotes inflammation of the surrounding connective tissue. Examples are perihepatitis, perinephritis, parametritis, etc. The suffix *pathy* is used to express the fact of a morbid condition without indicating its character. Instances are arthropathy and encephalopathy. A termination in *oma* signifies a tumor—as sarcoma, carcinoma, myxoma."

It is thus seen that the effort to introduce names expressive of the character and seat of morbid conditions has been in a considerable degree successful, while further improvement in nomenclature will no doubt be made as pathological investigation becomes more perfect.

Classification of Disease.—Various classifications of diseases, or systems of nosology, have been adopted by different writers; none of them as yet, however, can be regarded as perfect or entirely satisfactory. But the first classification deserving of mention is that into (1) *general* and (2) *local* diseases. "General diseases include those in which the whole system is involved from the commencement, and it comprises as subdivisions: (*a*) The *acute specific fevers*, and certain other diseases due to the introduction of some morbific agent into the body from without, or in some instances developed within the system—for example, malarial, typhoid, and scarlet fever, variola, hydrophobia, syphilis, pyæmia, and septicæmia; (*b*) The so-called *constitutional*, *cachectic*, *diathetic*, or *blood diseases*, some of which seem to depend upon the production of deleterious elements within the system which are capable of recognition, such as rheumatism and gout, while others are independent of any such obvious pathological causes, but are supposed to be severally associated with a peculiar dyscrasia or diathesis; for instance, cancer, tuberculosis, scurvy, rickets. *Local* diseases are those which primarily affect particular organs or tissues, each being liable to its own peculiar lesions. Thus we have diseases of the lungs, heart, stomach, liver, kidneys, brain, and the other organs; of the mucous membranes, serous or fibro-serous membranes, skin, periosteum, bone, and other structures. This division into general and local diseases is useful within proper limits, but it must be remembered that general maladies are often revealed or accompanied by local lesions, and that complaints which are originally local often more or less speedily set up general disturbance. Moreover, it is still a question whether some maladies are to be regarded as general or local in the first instance.

"Another division of diseases, which applies more particularly to those which are of a local nature, is into (1) *organic*, or *structural*, and (2) *functional*. These terms are self-explanatory, the former implying that there is some organic change in the affected part, which we can discover and demonstrate, the latter indicating that there is mere functional disorder, which is independent of any recognizable lesion. That there are structural changes in many affections which are regarded as functional is, however, highly probable, though our means of observation are not sufficiently powerful to enable us to detect them. In connection with each organ, a special classification of i—

individual complaints under one or other of these primary headings is usually adopted, this subdivision depending upon the affections to which the particular organ is liable. As illustrations of functional disorders may be mentioned disturbed action of certain organs, as of the heart, causing palpitation; derangement of the secretory or excretory functions, as in the case of the stomach, liver, or kidneys, and many nervous disorders. Organic diseases are exemplified by inflammation and its consequences: alterations in growth and development, degeneration, malformations, and new growths. Again, diseases may be classified according to their causation and mode of origin. Thus they are divided into (1) *hereditary*, or those which are transmitted either directly from parents to children, or, indirectly, as the result of a family taint; and (2) *acquired*, or those which are developed anew in persons free from hereditary taint. When morbid condition exists at birth it is said to be *congenital*. Other divisions, founded on an ætiological basis, are into (1) *contagious*, or *infectious*, and (2) *non-contagious;* and into (1) *specific*, or those diseases which are due to a specific cause, and (2) *non-specific*. There are other classifications which may also be mentioned. Thus, for example, diseases have been classed according to their intensity and duration. They are said to be (1) *acute*, (2) *subacute*, or (3) *chronic*. Another arrangement, founded upon their mode of progress, is into (1) *continuous;* (2) *periodical*, or affections which come on at more or less definite intervals; (3) *paroxysmal*, or those which are characterized by sudden or acute paroxysms; and (4) *recurrent*, or diseases which tend to recur. Lastly, according to their mode of distribution among communities or in districts. Complaints are said to be (1) *sporadic;* (2) *epidemic;* (3) *endemic;* and (4) *pandemic*, the meanings of these terms being sufficiently familiar to indicate the mode of distribution of the diseases to which they are applied.

"With regard to the classification of diseases which is likely to be permanently adopted in the future for general use, it is now thought probable that this will be founded on a pathological basis, and that, as our knowledge of morbid conditions and processes becomes more accurate, extensive, and definite, it may be possible to establish a system of nosology which will be both scientific and practically useful."

ETIOLOGY OF DISEASE.

Whatever is capable of damaging the structure of any organ or tissue of the body, or interfering with its function, may be a cause of disease. This definition implies that such causes are numerous, and that of many science is yet ignorant. To give a complete account of them is therefore very difficult, nor is the difficulty diminished by the fact that in most diseases we can trace a succession or combination of causes.

The intensity of morbid causes, the circumstances under which they act, and the condition of the individuals subjected to them, are so infinitely various as to render it quite impossible that any great uniformity should be found in their effects. The individual who to-day is proof against the infection of an epidemic malady may, by the loss of a single night's rest, become its easy victim on the morrow. Of a large number of persons exposed to the same morbid influence no two may be affected in precisely the same way. A certain degree of heat or cold, or stimulation of any kind, may not only be well supported, but enjoyed, and yet a very slight augmentation of the same action may give rise to violent or destructive disease. It is impossible to predict with certainty that a particular effect will result from the application of a given cause, and equally so to assert which one, out of all possible influences, may have given rise to a particular case of disease, unless those immediately antecedent to the attack be minutely detailed.

General Classification of Causes.—"The causes of disease have been divided into (1) *predisposing*, or *remote;* (2) *exciting*, or *proximate;* and (3) *determin-* . Illustrations will explain what is meant by these terms: Two individu-

als are exposed to the contagion of typhus in equal degree; one, wearied by bodily and mental labor, 'catches' the disease—that is to say, his condition has *predisposed* him to the exciting cause of the malady; the other, in vigorous health, escapes the contagion—the *exciting* cause of disease. Predisposition, in fact, *prepares* persons by rendering them more susceptible to the influence of exciting causes of disease. Many persons are *predisposed* to emphysema because of hereditary taint; in them the air they breathe is day by day an *exciting* cause of this disease; they contract a bronchitis which, by its attendant cough, *determines* the malady. Such illustrations might be extended to a multitude of diseases and justify the division of causes which the older physicians made.

"Predisposition may be inherited, or it may be acquired and be due to various accidental causes. In most cases there is a combination of predisposing causes; in a man, for example, lowered by fatigue, want of food, and exposure, debauch will readily excite an attack of bronchitis or pneumonia. Practically, it is often difficult to say how much is due to predisposition, but, though many factors unite in the predisposition to disease, it is possible in most cases to determine the part played by each. Again, it is not always easy to distinguish predisposing from exciting causes. In fact, predisposition carried to excess becomes an exciting cause of disease, and in many cases there is a combination of both. There are certain distinct exciting causes—for example, heat, cold, or injuries of various kinds, but most of these can claim a predisposing power. The contagia of the acute specific diseases and parasites are good examples of direct exciting causes."

Such causes have been called specific, as they not only engender distinct diseases but which are supposed to be alone capable of exciting the diseases which follow their application. Yet even specific causes, whose operation is of all others the most independent, can not be said in every case to produce these peculiar effects without a predisposition on the part of the individuals attacked. Thus the virus of small-pox would at first sight appear capable of generating the disease in all persons to whom it is applied; the susceptibility to it would seem to be universal. It is notorious, however, that some escape the malady, though frequently exposed to it, and even can not be made to receive it by inoculation. It is still more a matter of common observation that some children may be vaccinated repeatedly before the operation proves successful. Hence a cause of one sort may, by a peculiarity in its action, come to belong to another class of causes, or fail to display its appropriate power unless conjoined with one of another class. The causes of disease which have been admitted as legitimate subjects of investigation may, however, for convenience of description, be arranged in two principal classes, the predisposing and the exciting. By *predisposing* causes are meant those which produce in the economy certain changes which prepare it for the development of disease. They are usually slow and gradual in their operation, and are not always cognizable, except by their effects. Such are the influence of climate, of sex, temperament, habits of life, etc. They may be either *general* or *special*, acting upon many at the same time, or upon a single individual. *Exciting* causes are those from which disease more directly springs. In this class may be included *general* exciting causes, or those which give rise to disease without determining either its nature or seat. *Special* exciting causes, which, while they occasion for the most part definite morbid states, are not the only ones from which those states may arise; such are nearly all those causes of disease which act according to physical or chemical laws, and whose actions can therefore be explained by those laws; and, finally, *specific* causes, the mode of action of which is still a mystery, and their substantial existence is rather to be inferred from the uniformity of their effects than from physical demonstration.

General Predisposing Causes.

The greater number of causes to be now considered consist in certain prevalent constitutions of the atmosphere, or in certain local influences, eit'

natural or accidental. The alterations of the atmosphere which generate disease do not, so far as can now be known, affect its gaseous components, but belong to its temperature, degree of moisture, and dryness, and to the effluvia which it holds in suspension. To these may be added its electrical state, which, however, depends so immediately upon the hygrometric condition of the air that but little advantage can arise from considering it separately.

High temperature of the atmosphere appears to favor activity in all the peripheral portions of the circulation, and, when long-continued, to give rise to inflammation of the brain, the skin, and the digestive organs. It is supposed also, by diminishing the activity of the respiratory function, to augment that of the liver, which, like the lungs, gives exit to a large portion of the carbonaceous matter of the system. On this account it is thought that hepatic diseases are so much more prevalent in tropical than in temperate regions. But *great heat*, if the air remain dry, is usually much less prolific of disease than when accompanied with humidity. In the latter case the disposition to inaction, which heat alone creates, is sensibly augmented; the skin —no longer able to part with the moisture of the body, and, by its evaporation, to maintain a tolerable temperature—is continually bathed in perspiration; the fluid which would otherwise have escaped from this emunctory is poured forth by the mucous membrane of the bowels, and the various forms of intestinal flux, diarrhœa and dysentery, prevail. It is this association of atmospheric influences to which must be chiefly attributed that most fatal scourge of infancy in this country—the summer complaint, or *cholera infantum*. It is the same also which appears to be a principal element in the generation of those pestilential maladies which devastate the neighborhood of marshes and certain other moist localities, although, as will be more fully shown hereafter, other agencies contribute to, and in fact determine, this result. It is remarkable that, although hot, dry air predisposes to cerebral, cutaneous, and intestinal inflammations, the lungs should be nearly always exempt from diseases in such an atmosphere, and scarcely less so in warm and moist weather.

Cold, on the contrary, while it may perhaps affect many of the organs which are deranged by heat, acts with peculiar violence upon those of respiration, possibly because their functions are notably augmented by a low temperature. Hæmorrhages and inflammations of the lungs are the frequent result of this cause, as are indeed these morbid states in other parts of the body. In general, dry, cold air imparts to disease an inflammatory type, while, on the other hand, a cold, moist atmosphere predisposes to chronic affections, or to those acute disorders which are peculiarly liable to become chronic, such as rheumatism and bronchitis; dropsies, with all their various organic causes and the various forms of tubercular disease, are ordinary effects of this cause. In short, the combination of cold with moisture is more prolific of disease than any other cause, or union of causes, whatever.

Seasons.—Heat and cold, dryness and moisture of the atmosphere, also deserve attention in these natural and ordinary combinations. One of the most interesting of those is the seasons. The influence of winter and summer may be inferred from the remarks that have been made respecting extremes of temperature. Mortuary statistics reveal the fact that in Great Britain and the northern part of this country the greatest number of deaths take place in winter; spring follows next on the list, then autumn, and last of all summer. The diseases of spring and autumn present a remarkable contrast. Those of the former are generally more acute, their symptoms more distinct, their duration shorter; they are more amenable to treatment and less subject to relapses, hæmorrhages, inflammations of the throat and chest, and in our climate quotidian and tertian intermittents of a mild type are peculiarly frequent at this season. Autumnal disorders, on the other hand, are more slowly developed, their characters more uncertain, their form is more insidious; they are more protracted, much more difficult to cure, and more subject to relapse, as well as to leave behind them organic alterations. 'ius the liver and the spleen very commonly remain affected after the inter-

mittent and remittent fevers of the Middle and Southern States. At this season all diseases of malarious origin abound, being directly excited by the sudden alternations of temperature between night and day, and by the imprudent use of fruits.

Climate and Locality.—"These differ widely in their predisposition to disease. Persons who have been accustomed to a particular climate frequently suffer when transferred to one differing from it, and, on the other hand, the sick often benefit by a change. Particular diseases flourish in particular climates, and particular organs suffer. In the tropics various epidemic fevers prevail which are unknown in this country, for they cease to exist when the temperature sinks below a certain level (about 60° Fahr.). Frosts very often cut short epidemics in our own country in like manner. Particular organs are predisposed to disease by climate, the liver in tropical regions, the lungs and kidneys in regions where the temperature is capricious. Climates differ as regards air, whether moist or dry, hot or cold; but, besides these things, the topography must be considered, and the elevation of districts. Plains, mountains, and valleys have various predisposing influences, and while much of such influences depends upon the configuration of the country, no little is due to the natural purity of the water and the nature of the soil." It is now known that where a proper system of drainage of soil-water is carried out, the tendency to pulmonary disease is very greatly diminished. Clay soils are cold and damp, and favor diseases aroused by these combined agencies; sandy and gravely soils readily drain themselves, are warm and dry, and thus far tend to protect those who live on them against disease.

"In large towns occupations are more lowering than in country districts, while the physical and mental strain is greater and has fewer interruptions. Late hours, intemperance, and prostitution prevail in towns to a greater extent than among the rural population. In towns, over-crowding checks ventilation, makes drainage difficult, so that subsoils become saturated, clouds the atmosphere with smoke and dust, intermingles the sexes (among the lower classes), so that succeeding generations are stunted in their development, and in a variety of other ways predispose to disease. Among children, rickets, scrofula, and tuberculosis are far more prevalent in town than country. The mortality among young children is far greater in towns than in country districts. Adulterations are an evil in large communities, affecting people of all ages."

There are several other conditions which admit of being ranked among general predisposing causes, since they may operate as well on masses as upon individuals, such as east winds, dense fogs in cities, putrid food, foul water, lack of fresh vegetables, the emotions of fear or anxiety—causes which may operate fearfully in camps, ships, and in beleagued towns in times of war or periods of panic, of famine and of great public distress. The social condition of a people has likewise a distinct influence on their diseases; this is nowhere so plainly seen as in the prevalence of insanity among civilized nations, its rare occurrence among barbarians, and, in the former, its exact proportion to the degree of political liberty possessed by them. The people of the United States are, politically, the freest in the world, and they also occupy a sorrowful eminence as furnishing, in proportion to their number, more cases of insanity than any other people.

SPECIAL PREDISPOSING CAUSES.

"These include that state of the body which renders it peculiarly liable to be affected injuriously by a morbific agent; *determining* in the case of a 'non-specific' agent the particular disease which it might induce in each of several individuals similarly exposed to it; while in the case of a 'specific' agent, or 'morbid poison,' it *determines* the relative liability of several individuals, similarly exposed to it, to become the subjects of the particular disease it is capable of originating, and also influences the severity

of the attack. Thus, of several persons equally exposed to severe cold, which, by chilling the general surface, produces contraction of the cutaneous capillaries and consequent internal congestion, some may not suffer seriously in any way; but one may be attacked by bronchitis, another by pneumonia, another by apoplexy, another by gastro-intestinal disturbance, another by jaundice, another by rheumatism, or neuralgia, or nephritis, and so on, according to the '*locus minoris resistentia*,' or the part of the body which the congestion most affects in each individual. Again, of several individuals equally exposed to the poison of cholera, some may escape altogether, while others will be attacked by choleraic disease; and of the latter, some may suffer only from diarrhœa; in others, nothing more may be induced than vomiting, cramps, and rice-water evacuations; while in others the disease may develop itself in its full intensity, and rapidly proceed to a fatal termination. The special predisposing causes of disease may be either *congenital* or *acquired;* and in the former case, unless induced by malformation, or by causes acting through the maternal system during pregnancy, it is usually *hereditary.*"

Thus it will be seen that the special predisposing causes are for the most part peculiar to the individual. That they include all that he is by virtue of his birth, age, sex, temperament, and constitution, and all that he has been made by his trade, profession, condition of life, his previous diseases, his residence, clothing, food, and other circumstances called hygienic; in other words, this class comprises all natural and acquired tendencies to disease.

1. *Age.*—This has a most important influence as a predisposing cause of disease; each of the different epochs of existence is more liable to some diseases than others. Some diseases never appear before a certain epoch, and some are almost unknown after a particular age, while others may and do attack with equal readiness persons of every age. The periods of age are thus subdivided:

1. Nursing (infancy)—from birth to 7th-10th months.
2. Childhood—from 1st to 2d dentition.
3. Boyhood—from 2d dentition to puberty.
4. Adolescence—from puberty to 20th-25th year.
5. Early manhood—from 25th to 45th year.
6. Later manhood—from 45th to 60th year.
7. Old age—from 60th year onward.

"This is regarded as an excellent division; but in no definition is there more need to look out for exceptions than in that of age. The term *age* is strictly comparative: some individuals are old at forty; others young at sixty. Persons fail with regard to particular organs while young in years, and, on the contrary, others acquire an increased power in the same as years advance, of which the brain affords an apt illustration. The minor organs of the body betray the like peculiarities, and in the early decay of the teeth, the changes in the hair and the skin, we meet with indications of old age, though the individuals are young in years. But generally the predispositions of the young and old are striking in their contrast. The young are exempt from fatty degenerations which are so common in advanced life, and, in consequence, many diseases among them are, *cateris paribus*, less deadly; and not only does age, by reason of the changes that naturally occur as life goes on, predispose to disease, but all outward conditions become changed. Many diseases are peculiarly frequent in *infancy* and *childhood.* In the former are found tubercular meningitis, hydrocephalus and cyanosis, icterus, etc.; in the latter, numerous disorders proceeding from dentition, strophulus, impetigo, and other cutaneous eruptions, including small-pox, scarlet fever and measles, glandular scrofula, mumps, gangrene of the mouth, diphtheria, stridulous and pseudo-membranous laryngitis, whooping-cough, convulsions, cholera infantum, and worms. Children, speaking generally, are apt to suffer from acute catarrhal affections of the mucous tracts, glandular iseases, skin diseases, tuberculosis of an acute type, scrofulosis, rickets,

and a variety of complaints traceable to improper feeding, bad ventilation, overcrowding, and to hereditary taint. From acute tuberculosis the aged are almost entirely exempt, and they do not suffer from hereditary taint nearly so frequently as the young. The very young and the very old are equally subject to bronchial catarrh, and the mortality from this disease at each extreme of life is exceedingly great. But in the young the predisposition to the affection is almost invariably associated with a predisposition to catarrh of the intestinal tract, and to diseases which indicate a general constitutional depression, while in the old bronchial catarrh is predisposed to by a degenerative change in the lungs themselves or in the air-passages. In childhood there is an active stage of growth and development, and when one important organ is affected, the others suffer with extreme rapidity; the excito-motory system is greatly developed, and hence arises a predisposition to spasmodic diseases—for example, laryngismus, stridulus, and to general or partial convulsions during the excitement of dentition. In the old the tendency to spasm decreases, and convulsions become much less marked. The fact of many of the infectious diseases being more common among children than adults is explained by the circumstance that the latter class have passed through the ordeal of those diseases, and are thus proof against them.

"The period of *adolescence* is often marked by disorders of the nervous and nutritive systems, as chorea, hysteria, and debility, and various derangements of the economy arising from a too rapid growth or an undue excitement of the sexual propensities. Thus we find that the onset of puberty is a constant source of predisposition to disease, for with it comes a complete transformation in the mental and physical characters. So that the individual, if not carefully watched, deviates from even the most perfect health into a permanent tendency to disease. The system at this period—especially in the case of females—is frequently unable to bear anything which interrupts or interferes with its activity. The generative organs undergo great changes, and with them the whole moral and physical nature is altered. At this period of life there is a predisposition to both bodily and mental diseases. In fact, perversions of any organ or faculty may be started; and, once started, they are apt to continue, so that there is established, literally speaking, a permanent predisposition to disease, and this predisposition swells very largely the list of affections which are dealt with under the generic term *hysteria*. If we except pure bronchitis, the various forms of lung affections are more common at and shortly after the period of puberty than in previous years—but, excepting in the instance of phthisis, hereditary taint is less manifested than during childhood. Even hereditary epilepsy is, if postponed beyond early years, likely to be postponed to the period of adult life. Although *adult life* is less remarkable for its liability to particular diseases than for its susceptibility to all, yet this period is distinguished by the frequent occurrence of pulmonary and intestinal affections, and those of the genital organs. Neuralgia, hypochondriasis, and other forms of insanity, the several varieties of organic and inflammatory disease, and hæmorrhages, are more prevalent during this than any other period of human life. As has been said, the degeneration of organs and tissues begin to show with much uncertainty, but after the fortieth year of life we almost invariably meet with one or other of them. Their degree and their consequences vary with the surroundings of the individual—with his habits, temperament, occupation, and like influences. Diseases of the large vessels are especially common at this epoch, such as aneurisms of the aorta and of the large arterial trunks in the extremities. Henceforward all the diseases peculiar to advancing age become common. The results of previous disease, of the prolonged and habitual neglect of hygienic rules, of overtaxing of the generative and digestive apparatus, now begin to disturb that serenity which should mark the evening of life. The slight and temporary indigestion of former days is followed by chronic dyspepsia and gout, or by organic disease of the stomach or liver; occasional constipation has become habitual and obstinate, and hæmorrhoids, fistula in ano, or scirrhus of the rectum succeeds. A little irreg

larity in the quantity of the urine, or slight difficulty in voiding it, is followed by enlargement of the prostate gland by unyielding stricture of the urethra or by stone in the bladder. At the same time the brain is liable to be attacked with softening, or torn by hæmorrhage, or its proper functions degenerate into mental imbecility. The arteries may become calcified, producing gangrene of the extremities, or those appalling symptoms supervene which arise from thickening of the valves of the heart. The results of previous disease are now declared by a decided predisposition to exciting causes which have been hitherto withstood. But 'old age' is a relative term; 'decline of life' is a better phrase. A man is old and predisposed to trifling excitements because his lungs have lost their elasticity, or the brain its regularity of circulation, or his heart its vigor; in each of these cases, as in a host of others, the predisposition is strictly one of degeneration. Again, inherited diseases do not declare themselves in some cases till the later years of life, and of this carcinoma is a striking example. The old are predisposed to lowering diseases—low pneumonia or bronchitis; and to a variety of nervous affections which the vigorous can resist. In them the failing heart-power tells a tale; they are the subjects of general vascular dilatation and weakness, and, in short, they succumb to insignificant exciting causes in consequence of the general or partial decay of the tissues and textures of the body."

2. *Sex.*—"There are great differences in the organs and functions of the sexes, and, in consequence, a great contrast in their predisposition to disease. The female is more delicately constructed than the male, and those organs which the two sexes possess in common differ in weight and in 'fineness'; and a general consideration at once indicates that the female is less fitted than the male to resist many exciting causes of disease." Although there are a great many diseases to which both sexes are equally liable, yet it is evident that each sex must have some maladies peculiar to itself, if we only regard those connected with the function of reproduction. The womb and its appendages constitute not only the anatomical peculiarity of women, but their natural and morbid actions distinguish her from man, both in health and disease. Hence the disorders which attend menstruation, pregnancy, and parturition, have no parallel among those of the opposite sex. Besides these, females are especially subject to tubercular consumption, chlorosis, crural hernia, cancer of the breast, uterus, and ovaries, with neuralgia, hysteria, chorea, and the whole catalogue of nervous disorders, some one of which, or some derangement of the menstrual function, is perpetually complicating and obscuring the inflammatory and other affections which attack this sex. The inability of females to resist the exciting causes of many diseases is particularly evident at the climacteric periods of life; with the onset of puberty, girls suffer far more than males, and especially from a variety of reflex spasmodic disorders which require but little provocation for their development. "All the phenomena classed under the head of hysteria often occur at this period. At the same time and shortly afterward there is a tendency to ulcer of the stomach, to persistent constipation, to peculiar attacks of neuralgia, especially of the intercostal nerves, and to acute rheumatism, lapsing into the subacute or chronic kind. Anæmia and chlorosis are also common at the period of puberty, and, if then neglected, they are apt to persist and predispose the individual still more to disease. Even so early as the period of puberty the external circumstances of the sexes differ, and on this depends, in a certain measure, the difference in their predisposition. Education, domestic habits and customs, and, above all, occupation, play an important part. But underlying these outside influences there is inherent in the sexes a difference in predisposition, for when they are exposed, as often happens, to the same surroundings, they suffer from widely separated diseases. Males are more subject to epilepsy, apoplexy, tetanus, gout, diabetes, locomotor ataxy, vesical diseases, and acute lung affections than females. The list shows that occupations which involve hard mental and bodily work, and constant exposure to atmospheric vicissitudes, physical injury, and to the several forms of intemperance, plain some of the varieties in predisposition. It is probable that females

are more frequently ailing than males, but very often their illnesses are associated with the menstrual functions, and are trifling in degree; and though more males are born than females, toward the later years of life the average of the sexes becomes more equally balanced, because the mortality of males is greater than that of females. It should be remembered that pregnancy and lying-in predispose females to diseases from which males are exempt, and that there is a considerable difference in the sexes as regards venereal affections, both as to predisposition and the effects of that predisposition."

3. "*Temperament* is important as predisposing to disease. The principal influence of the *sanguine* temperament consists in giving a marked inflammatory character to diseases, and in predisposing to plethora—to congestions of organs and hæmorrhages on comparatively small provocation.

"The *lymphatic* or *phlegmatic* temperament predisposes to those diseases which are readily excited by want of mental and bodily energy, and it creates a tendency to mucous and serous fluxes, catarrhs, and passive dropsies, tuberculous and scrofulous affections of the lungs, joints, skin, etc. These diseases have one feature in common: they are all chronic. Slowness of evolution is one of the most striking characters of this temperament. It is marked by sluggishness of mind and inertness of body, as well as by tedious development of disease.

"The *nervous* temperament is the direct opposite of the last, and is marked by quickness and susceptibility. It predisposes to all forms of disease which affect the nervous system; but more particularly to functional disorders, to insanity, convulsions, and neuralgia. Individuals with this temperament are easily excited and easily depressed, so that excitants are apt to cause either a form of hysteria, or hypochondriasis. Nervous persons are particularly predisposed to the acute specific diseases, and they suffer quickly from delirium and other brain symptoms, which aggravate and render dangerous an otherwise hopeful malady. It also incites and modifies the course of other acute diseases, and, by the complication of disorders of the nervous system, renders their symptoms more violent and their issue more uncertain.

"The *bilious* temperament is said to predispose to affections of the digestive organs, and to modify the type of various other diseases by adding to them bilious symptoms. But the existence of this temperament in an individual does not seem to be very susceptible of proof until the actual occurrence of hepatic disease. Unlike the sanguine temperament, it is not a physiological condition. Practically, we meet with mixed temperaments, though one, perhaps, especially prevails."

4. *Constitution.*—An individual's constitution may be strong or weak. A robust constitution is the substantial representative of perfect health, and can not therefore be said to predispose to disease, but, on the contrary, must offer the strongest possible resistance to morbid causes. But, on account of the very energy with which all the vital actions are performed, when once a person of strong constitution becomes affected with disease, these very actions in their perverted state are executed with singular vigor; in other words, the diseases of a strong constitution are also strong, and prone to assume the inflammatory type.

Delicate or feeble constitutions, on the other hand, are more susceptible of injurious impressions, and react less powerfully under them. They are easily prostrated and exhausted, unable to offer much resistance either to the disease or to the treatment required to cure it; and, in fact, they are peculiarly subject to latent forms of disease—to those which run their course of structural disorganization without betraying themselves by distinct symptoms, and, consequently, without inviting the interposition of medical art. If the diseases of the robust are more violent, they have also more strength to overcome: if those of the feeble are apparently mild, they are not so in proportion to the ability of the patient to sustain them. It is a common error to suppose that a certain delicacy of constitution is of itself favorable to longevity. "Without that prudence which a consciousness of danger inspi

the feeble would not survive." "The robust perish, because they are unmindful of the dangers which perpetually surround them."

One of the effects of modern civilization is the increase of the average duration of life. But it must be conceded that a large proportion of this increase is the result of a larger number of feeble children now saved by means of the additional physical comforts which have been enjoyed by each successive generation for the last two centuries. The average duration of life is greater than formerly; but individual examples of vigor are more rare, and probably the sum of physical force is less for the same population.

5. *Idiosyncrasy* in the sense here used is a peculiar susceptibility to or immunity from certain diseases upon the part of an individual. In its wider significance it would include nearly all personal peculiarities, among them those which relate to the action of medicines, etc. The term is frequently applied to acquired peculiarities, but should be restricted to those implanted by nature. One of the most remarkable is a natural tendency to hæmorrhage, so that slight injuries are made dangerous, and sometimes result fatally. Certain articles of food can not be eaten by some individuals with impunity; thus certain shell-fish produce an attack of urticaria, or of coma resembling narcotism. With others, for instance, eggs, honey, sugar, or mutton, may produce gastric pain, nausea, or vomiting. Strawberries are to a few persons a most deadly poison, producing symptoms of intense nervous shock. With some, convulsive spasms may be excited by the smell of musk, asthma by the inhalation of powdered ipecacuanha. Some are distressfully affected in both bodily and mental ways by the exhalations of certain animals—the cat in particular. Sometimes vision may be the channel of affection, and syncope produced by the sight of blood. In the investigation of disease, therefore, we should remember that certain kinds of food or drugs that may be swallowed, of gases or dusts inhaled, or of certain substances brought in contact with the skin which are quite harmless to the majority of men, may still, for this or that individual, prove irritants and poisons.

> "Some men there are love not a gaping pig;
> Some, that are mad if they behold a cat;
> And others, when the bagpipe sings i' the nose,
> Can not contain their urine."—*Merchant of Venice.*

6. *Heredity* is a prolific source of predisposition. There are family diseases, just as there are family features, and peculiarities of gait, gesture, or character. Of the affections generally admitted to be propagated by inheritance, the most prominent are tubercle, cancer, organic diseases of the heart, emphysema of the lungs, insanity, epilepsy, gout, gravel, and apoplexy. In general, the predisposition only, and not the disease itself, is transmitted, for this latter does not usually make its appearance until adult life or until after the age of puberty, and even then it often appears to be the result of habits of living, or other causes, competent of themselves to produce it without taint of the ancestral blood. But these very habits, etc., are commonly an evidence of the influence of the parents' constitution; for tastes, talents, and propensities are inherited just as certainly as form and feature. It occasionally happens that an hereditary disease, in the sense just explained, becomes so in the vulgar sense—that is to say, is communicated to the child in the womb, and affects it at birth. This may be the case with tubercles and other forms of scrofula. Syphilis and small-pox may be directly transmitted from the parent to the child. The diseases of the mother are said to be more certainly transmissible than those of the father. The age at which the hereditary tendency displays itself in the development of a particular disease depends upon the nature of that disease. None that is clearly hereditary, except the glandular form of scrofula, becomes manifest anterior to the age of puberty. Subsequent to this epoch we meet with, first, phthisis pulmonalis, epilepsy, and insanity; in the early part of adult life, emphysema of the lungs and hypertrophy of the heart, and, somewhat later, gout, gravel, carcinoma, and apoplexy. Many of these hereditary diseases display a tendency to evolve themselves at a period of the child's life corresponding to that at

which the parent was first attacked, and thus the melancholy spectacle is not infrequently presented of all the members of a large family cut off by the same disease on arriving at a certain age. "Where both parents are the subjects of the well-marked diathesis, the transmission of it to the offspring is almost a certainty, and the manifestation of it is likely to be yet more marked if the parents inherit also the same family *idiosyncrasies*. Although the predisposition to *insanity* is often undoubtedly hereditary, it does not seem to partake of the constitutional nature of a diathesis except where it depends on the existence of some definite form of malnutrition. The fact seems to be that the nervous system is so peculiarly liable to be shaped and modified by the mode in which it is habitually called into exercise that it takes on a particular *abnormal* form of activity far more readily than any other organ, and for this reason: when a special form of malnutrition has once established itself, this may be transmitted to the offspring, without the prolonged action of its special factor, through successive generations. This is particularly seen in the effect of habitual alcoholic excess, which not only produces a tendency to insanity in the subject of it, but also engenders in the offspring (especially when *both* parents are drunkards) a disordered state of brain-nutrition, which may express itself in idiocy, epilepsy, alcoholic craving, mental instability, weakness of will, uncontrollable hysteria, and other neurosal affections, as well as insanity. And the same may be said of abnormal moral habits, which, when they have fixed themselves in the cerebral organism, tend to reproduce themselves, and are liable to crop out in succeeding generations, as we see in hereditary kleptomania and other immoral propensities. But of all these acquired forms of disordered *neurosis* it may be said that as it is the peculiarity of the nervous system to rapidly grow to the mode in which it is habitually exercised, so there is less tendency to the hereditary perpetuation of such disorders than where it depends upon an established diathesis, provided the right methods of physical and moral invigoration have been employed for the restoration of the brain's normal activity. There is among individuals not only an inheritance of such diseases as have been mentioned, but of peculiarities in the manner they meet and pass through minor ailments. Thus, in families of a nervous history we meet with predispositions to headaches of nervous type, irregularities of digestion in the form of diarrhœa and vomiting, and a multitude of conditions which have of late been ascribed to vaso-motor disturbances." The members of some families live long, in spite of exposure to almost every exciting source of disease, and contrast most favorably with others, who, as far as one can determine, have all things in their favor. Some individuals appear to be predisposed to bronchitis and other catarrhs, as well as many other minor complaints, by inheritance. It has been asserted, and certain facts seem to warrant the belief, that there is even a predisposition by inheritance to the acute specific diseases, such as typhoid fever and diphtheria. However this may be, there is no doubt that the effects of many constitutional diseases are handed down from generation to generation. It is supposed that the inheritance lies in the tissues themselves—that there is something in the tissue-elements which predisposes to certain diseases in certain families.

7. *Previous Disease.*—With the exception of those affections which occur but once in the same individual, nearly all others have a tendency to return. Thus it is very rare indeed for a person to experience only one attack of spasmodic croup, gout, epilepsy, hysteria, etc. Every organ that has been once inflamed is peculiarly liable to repeated attacks of inflammation. The first of these may be said to predispose to those which follow, because the original affection has so far modified the structure of the organ as to render it more susceptible than at first to disturbing influences. "Previous disease, therefore, often predisposes to the same or to some other affection, and no clinical history is of value unless it includes an account of former illnesses. In difficult and doubtful cases a true statement of these often gives the clew to diagnosis, and even patients themselves are alive to the value set upon an accurate account of their life ailments. An attack of croupous pneumonia predispose

to recurrence, especially during the twelve months succeeding the attack, and it may leave behind a predisposition extending far beyond the original disease. Acute rheumatism, tonsillitis, erysipelas, as well as chorea and many other neurosal affections, tend to recur, but in all these, and many other cases, it is difficult to estimate the exact part played by *derived* predisposition, because in all the *primary* predisposition may be the main agent in the subsequent attacks. In practical medicine it is distinctly recognized that certain diseases predispose to disease, and in their cure recurrence is, very properly, anxiously guarded against. Pertussis is supposed to predispose to measles, and *vice versa*. There is distinctly a connection between chorea, rheumatism, and scarlet fever, and these diseases may follow one another in any order. Again, previous disease may leave behind pathological lesions which remain in abeyance until excited by causes which the healthy individual could readily withstand. Pertussis often ends, to all appearances, favorably, but afterward the patients may suffer from severe lung affections upon trifling exposure to exciting influences. Calcareous deposits in the lungs may excite a new catarrhal phthisis; hepatic mischief, followed by collection of gall-stones in the gall-bladder, may cause peritonitis and other diseases. Slight complaints are even more marked in their predisposing powers than serious diseases." On the contrary, in the case of the so-called specific diseases, an almost perfect immunity is acquired by those who have already suffered from them, as regards a second attack of the same affections. Vaccination may save nations from the most terrible of scourges, and in this way previous disease sometimes not only protects individuals, but communities.

8. *Occupation and Habits of Life.*—These are among the most powerful of the causes under notice, and may be considered together, inasmuch as the habits of an individual are determined chiefly by his ordinary pursuits. Those which require exercise in the open air are most likely to induce inflammatory disorders, while such as are consistent only with a sedentary life dispose to affections of a lymphatic type; and if conjoined, as they frequently are, with continued mental application, they occasion cerebral hyperæmia; and if with excessive indulgence in eating and drinking, they bring on general plethora, cutaneous diseases, and derangement of the digestive and urinary apparatus. They very commonly also give rise to hæmorrhoids and fistula in ano. Particular employments occasion particular diseases; those who ride much on horseback are liable to hernia and enlargement of the prostate gland; singers, and all who use the voice excessively, to affections of the larynx; bakers to rheumatism. The influence of occupation in the causation of disease is increased by lack of hygienic conditions. The over-crowded in workshops breathe an impure air—an air loaded with carbonic acid, irritant particles, and various exhalations, and thus are liable to disease. Miners breathe an air laden with carbon; knife-grinders inhale fine particles of metals; marble polishers, stone masons, and those who work in planing mills and brass foundries, are in the same plight; in all these cases, occupation, combined with neglect of hygienic precautions, leads to pulmonary diseases. It is true that occupation is sometimes a direct cause of disease, as, for example, with workers in arsenic, antimony, copper, lead, the mineral acids, etc., who may suffer from the poisonous effects of these substances. But oftentimes they escape the direct influences, yet are subject to a predisposition to various diseases as a consequence of their occupation; and so various other occupations, according to their nature, predispose to disease in different ways.

"Too much work and too little work (mental or bodily) predispose distinctly to disease. Continued overwork reduces the system generally, and special organs in particular, according to its nature. Thus a coachman, who uses for many hours his pectoral muscles in driving, suffers chiefly in them when he has an attack of muscular rheumatism. So also those who use the brain too much in intellectual work are predisposed to functional, and even to organic, derangements of the nervous centers. Physical overwork is often conjoined with exposure and improper or irregular food-supply, and he combination has a marked effect. It has so predisposed armies to disease

that their ranks have been decimated by fevers, pneumonia, bronchitis, and other ailments, far more than by the cannon or by the sword. Not a few medical men have been affected by the contagia of the acute specific diseases, because when exposed to them they were worn out by bodily and mental exertion and by protracted fasting. Overwork reduces the nervous power and thereby strikes at the very root of the healthy status. On the other hand a sluggish use of the mind or body is favorable to disease, and some persons are so constituted that they cease to be safe when their minds have lost their opportunity of active exercise; and the very fact that they substitute an abnormal intellectual employment is proof of this truth. And what is true of the mind is true of the body. A sudden change from active bodily exercise to bodily laziness predisposes largely to disease."

9. *Fashion in dress* is by no means unimportant as creating a predisposition to disease. Garments which leave a portion of the surface of the body uncovered, expose to attacks of rheumatism, catarrh, pneumonia, and other inflammatory affections produced by atmospheric vicissitudes. Too warm clothing disposes to very similar consequences, by promoting unduly the cutaneous transpiration, rendering the surface of the body more sensitive to cold, and so reducing the strength as to increase the susceptibility to all injurious impressions. Too warm beds act much in the same way, and in females are a prolific cause of excessive menstruation and leucorrhœa. Warm cushions incline to the disorders of females just mentioned; besides which, they pretty surely give rise to hæmorrhoids.

Garments often act injuriously by compressing different parts, by thrusting organs from their normal position or interfering with their proper functions. Tight corsets are remarkably pernicious in this way: they compress the stomach and prevent its reception of sufficient food, or the digestion of what it receives; they so hamper the liver as to change it from a flat to a conical figure, and imprint upon its surface the outline of the ribs; they prevent the descent of the diaphragm and the expansion of the chest, and thus enfeeble the lungs and displace them, even when they do not disorder the heart; they debilitate the muscular walls of the abdomen and interfere with the passage of the food through the bowels, thus giving rise to constipation with all its consequences; they press upon the gravid uterus, and sometimes produce abortion; or, failing of this effect, may occasion some malformation of the fœtus, which reduces it to the class of monsters; and, finally, they arrest and destroy all that development of the mammæ and upper part of the chest which is not only one of the greatest of female charms, but which is of the highest importance to the mother. Tight cravats and other garments compressing the neck tend to produce congestion of the brain and apoplexy; tight garters cause œdema and varicose veins of the legs; while tight shoes deform the toes of growing children, giving rise to corns, bunyons, ingrowing nails, impede the functions of the general circulation, and sometimes predispose to constitutional disease, or may produce sympathetic disorders in distant parts by increasing reflex-nervous irritability.

10. *Food and Drink.*—The effects of insufficient food are too well known to need description here. Debility includes them all, for it invades every function of the economy, whether organic or mental. If, as Bichat defined it, "life is the sum of the powers that resist death," and if disease be only the instrument of death, of course whatever enfeebles life predisposes to disease. The ravages of famine in besieged towns, and the epidemic maladies which so often desolate the lower classes of humanity in different parts of the world, denote this influence on a large scale. The type of these disorders is adynamic. The diseases of the poor and the wealthy, when contrasted, show the influence of opposite modes of living. The former are for the most part those of debility, as typhus fever, scurvy, scrofula, and dysentery, while the latter generally proceed, in the first instance, from over-stimulation, and include gout, gravel, dyspepsia, hypochondriasis, apoplexy, etc.

In further consideration of *acquired predisposition*, it should be stated t- any habitual infraction of the laws of health will induce a general *lia*

to disease by producing a depressed condition of the vital activity, whereby the organism is rendered less capable of resisting the influence of morbific agents. But this infraction may be of a kind which induces a liability to some particular disease, as when the habit of rapidly eating a large meal tends to injure the digestive power, or the habit of living in over-heated rooms predisposes to bronchial and pulmonary attacks.

It is, however, in determining the invasion and epidemic spread of diseases that depend upon the *zymosis* set up in the blood by the introduction of certain specific poisons that the effect of "*acquired predisposition*" is most distinctly seen and can be most definitely expressed. During the severest visitation of cholera or diphtheria, for example, the number attacked is really small in comparison to the entire population; and while of those who escape the great mass may be assumed not to have been exposed to the action of the poison at all, yet it is unquestionable that a large proportion of those who are as fully exposed as those attacked by the disease do not become the subjects of it.

A medical practitioner, again, may unconsciously carry about with him a septicæmic *contagium* which is innocuous, not only to himself, but to a large proportion of the persons with whom he comes in contact; and yet it may take fatal effect upon certain individuals who nevertheless have received no stronger a dose of the poison than the rest. Further, it is not infrequently seen that the practitioner or nurse who long seem completely "proof" against any attack of the epidemic malady to which he (or she) is administering, at last succumb to its influence. It is evident, in these and similar cases, that there must be some "predisposing condition," not supplied by the *normal* human body, which determines the zymotic action of the *materies morbi* in the individuals who manifest its effects.

Such "predispositions" have been recognized and specified by all who at various times have scientifically studied the etiology of epidemics; and it has been universally noted that unwholesome food, bad water, and foul air have exerted a singular potency in favoring the action of the poison on individuals and communities. The advocates of the "germ theory" and of the "chemical theory" of zymotic poisons unanimously concede the fact that the presence of nitrogenous matter in a decomposing or readily decomposable state affords the best possible *pabulum*, either for the development of bacillar organisms, or for the action of ferments. And, building on this foundation, Dr. William B. Carpenter, of London, many years ago came to the conclusion that the common condition which *all* those agencies tend to produce, which experience has shown to be especially favorable to the development of zymotic disease, is this: "The presence in the blood of the individual attacked of an *excess* of those decomposing effete matters with which the circulating current is normally charged to a limited amount during their passage from the parts of the body in which they are poured into it to the excretory organs by which they are eliminated and cast forth. If the amount of these matters be limited to that which is being continually generated in the ordinary 'waste' of the body, and if the great emunctories (the lungs, the liver, the intestinal glandulæ, the kidneys, and the skin) all do their proper work, the products of that 'waste' are drawn off from the blood-current as fast as they are poured into it, so that the stream is kept pure. But if, on the one hand, such decomposing matters be either abnormally introduced from without, or be generated in abnormal amount within the body; or if, on the other hand, the normal process of elimination be in any way obstructed; or if, still more, an abnormal excess of the one process concurs with deficient activity of the other, a rapid accumulation of these matters takes place in the blood, and thus, by providing the *pabulum* requisite for the development of the poison, supplies the very condition necessary for the morbific activity.

"Of the effectiveness of the *introduction* of putrescent organic matter, either food, water, or air, the cholera epidemics of former years afford instances glaring' that they need only to be adverted to. Of even more marked

potency of the *excessive generation of effete matter within the body*, we have a typical example in the extraordinary proclivity of the *puerperal female* to suffer from the action of any septic poison to which she may be exposed. Nothing can be plainer to the physiologist than that the return of the uterus after parturition to its non-pregnant condition involves a rapid 'waste' of its muscular substance, the products of which will be poured into the blood-current far more rapidly than can be eliminated, this state continuing until the process is completed. The like condition exists in subjects of *severe injuries* and of *operations*; and not only do these exhibit a special proclivity to the action of specific poisons like scarlatina (the disease only then declaring itself, although its germs may have been previously received and lain dormant), but they show a peculiar liability to suffer from the ordinary septic poisons which have no effect upon the healthy carriers of them, erysipelas and adynamic 'surgical fever' being thus communicable. *Excessive exertion*, again, whether bodily or mental (such excess being marked by the *sense of fatigue*), has always ranked among the most potent of predisposing causes of disease; and its action is clearly traceable to the same source, the abnormally rapid 'waste' of the tissues, whereby the blood-current becomes unduly charged with the products of their disintegration. It is within the experience of every one that the *sense of fatigue* bears no constant proportion to the amount of exertion put forth; and that while, on the one hand, any obstruction to the eliminating processes (as by bad ventilation of the sleeping apartment) prevents its removal by rest, an unusually severe and prolonged strain may be sustained without its induction when the excretory apparatus is stimulated to increased activity, as in 'training.' And there is strong reason, therefore, for regarding this feeling as indicative of the degree in which the *blood is charged with the products of nervo-muscular 'waste.'* Ample evidence is afforded by army experience of the special liability of soldiers to zymotic diseases when on long and fatiguing marches; and this especially in hot climates, where, the activity of the respiratory process being reduced by the high external temperature, the products of the 'waste' tend to accumulate in the blood-current.

"Of the predisposition induced by the accumulation of effete matter consequent upon *obstructed elimination*, none is more marked than that which results from *over-crowding*. The effect of defective air-supply is not only to reduce the quantity of carbonic acid got rid of by expiration, but also (which is probably of greater importance in relation to zymotic disease) to diminish the *normal oxidation* of those nitrogenous effete matters of which (when thus metamorphosed) it is the special business of the kidneys and the skin to get rid of. The accumulation of these within the body speedily makes itself manifest in the offensiveness of the *halitus* of the breath (the condensation of which shows the presence of fetid matter), and of the cutaneous renal and intestinal excretions; and thus, although there may be no introduction of decomposing matter into the body, or specially rapid internal production of it, the blood-current becomes as effectually charged with the *pabulum* of the zymotic poison as if this had been injected into it.

"The strong predisposition to zymotic disease induced by *intemperance* seems clearly traceable to the same source. For the habitual presence of alcohol in the blood-current undoubtedly diminishes the oxidation of the 'waste' products and thus occasions their accumulation in the system; and this at greater rate in hot climates than in cold, on account of the already reduced activity of the respiratory process in the former. Where, again, the rate of 'waste' is abnormally increased, as during protracted physical labor, the evil influence of alcoholic liquors is still more strongly manifested; and this will be again aggravated by over-crowding in ill-ventilated apartments. The connection between *famine* and *pestilence* is another argument in favor of the fact that a state of general blood contamination is produced by the accumulation of non-eliminated products of 'waste.' Where people are suffering from famine, the fetid secretions from the skin, the rapid supervention of general putrescence after death, and its manifestations even previously

the frequent termination of life by colliquative diarrhœa, all evidence the peculiar fitness of the body so conditioned for the development of a zymotic poison. And thus we seem furnished with a scientific *rationale* for all that experience has taught as to the conditions of the spread of zymotic disease; which, by giving greater definiteness and consistency to medical doctrine, will afford a surer and more positive basis for preventive *hygiene*, both public and individual. But, while the contamination of the blood-current by the accumulation of 'waste' products most strikingly manifests itself in establishing a predisposition to zymotic disease, and in aggravating the severity of its attacks, there can be no doubt that it lowers the healthy vigor of the body generally, and in this way also renders it more ready to be affected by any disease to which it may be *constitutionally* liable. Where any form of malnutrition exists—whether resulting from imperfect performance of the primary digestive processes, producing ill-made blood, or from imperfect conversion of blood into tissue—there must be premature degeneration and augmented 'waste,' and the rate of this augmentation must tend to increase, if special *attention* be not given to the *eliminating* processes. Here we have the *rationale* of the fundamental importance of pure fresh air, as cool as can be borne, to the scrofulous subject; and of the remarkable cures sometimes effected in patients in whose lungs tubercular deposit has already commenced by the hazardous discipline of a hardy out-door life. When any serious malady has once established itself, the degeneration of tissue, as shown by the rapid wasting of the body, takes place with augmented rapidity; and the necessity for the removal of its products is proportionately urgent. And this is not the less important when the progress of the disease is stayed; for the purification of the blood from the contamination it has received is absolutely essential to the establishment of those recuperative processes on which the final issue depends. Of the due elimination of the 'waste' products, their *oxidation* is the first and most fundamentally important act; and of the direful consequence of past ignorance and neglect of this principle—evinced on a large scale in the over-crowding and bad ventilation of hospitals, poor-houses, and prisons—their records too surely tell." Even now our practice is far from perfect in this particular, and it is scarcely going too far to affirm that not only the public but the medical profession have still much to learn as to the importance of *pure air* for the *prevention* as well as the cure of disease.

General and Special Exciting Causes.

Exciting causes may be divided, as stated, into general, special, and specific. The first of these divisions includes all those which directly develop disease without determining its nature or seat, and, consequently, embraces all which have been enumerated as predisposing causes; for when their action, instead of being protracted and feeble, is sudden and energetic, they not only promote, but actually determine, some morbid state. Without, therefore, again treating of all of these in their new aspect, it will still be proper to refer to one or two.

Cold is the most common cause of disease in temperate climates, especially in the changeable climate of this country. It can excite disease directly, and can effect, probably, all the organs of the body, causing either disturbed function or organic disease. Cold, when severe, contracts the vessels, interferes with the circulation and all vital activity, and in this way may cause death. But it is with moderate degrees of cold we have chiefly to deal. A momentary exposure to a cold draught playing upon the cheek may cause facial paralysis, sore throat, or bronchitis; that is to say, cold applied locally may excite disease in the vicinity of its application or in distant organs. It is probable, therefore, that cold may act in several ways: (1) It may interfere with the circulation; (2) it may affect the extremities of nerves and excite disease by reflex action; or (3) it may check secretions of the skin, the mucous membranes, etc. We can not wonder, therefore, that diseases of the throat, larynx, and lungs are frequently excited by cold

Bronchitis and pneumonia are its most common results; and, as the young and the old are less enduring of cold than those in the prime of life, it carries them off with great frequency. Diarrhœa, renal diseases, congestion of the liver, acute and chronic rheumatism, and a host of other affections, are traceable in many instances to cold. Predisposition has much to do with the effects of cold; some individuals suffer from one form of disease when exposed to it, others from entirely different affections. In some a "common cold" is most evidenced by severe muscular pains and fever; in others by nasal discharge; in others by headache, and so on. Some persons never suffer from "cold" without an attack of herpes labialis; and numerous similar idiosyncrasies might be given. The effects of cold should always be considered with almost all predisposing causes of disease. But "cold" is a vague term, and not thoroughly understood; for this reason its precise effects in individual cases ought to be most carefully considered and recorded. With reference to "*heat*" as an exciting cause of disease, it should be stated that it may induce such diseases as inflammation of the membranes of the brain, or excite cerebral mischief just short of death, while in persons of tubercular diathesis it may induce tubercular meningitis, or it may kill suddenly, as in *coup de soleil*, and many morbid effects follow severe local applications of heat. Choleraic attacks in this country usually are associated with exposure to immoderate heat.

Moral Conditions and Mental Emotion.—The brain is not only the instrument of the mind, but it presides over and controls the functions of all the other organs. Its own disorders can hardly fail, therefore, to affect them. Strong emotion may not only suspend or pervert particular functions, but is even capable of destroying life by arresting the action of the heart. Sudden mental worry may excite dangerous interference with digestion, or start an abnormal cardiac rhythm. Mental and moral shock can check or increase the flow of urine, and, in fact, can affect all the excreting and secreting organs of the body. "The pernicious influence of habitual grief upon the nutritive functions are plainly marked. Under its corroding blight, the skin loses its freshness and grows dry and yellowish; owing to the derangement of the liver, the bowels become confined, and their habitual constipation is apt to be followed by permanent disease in their lower portion, and by congestion of the brain with all its consequences. Anger often brings on a convulsive attack, and insanity frequently follows close upon exaggerated mental effort, and especially upon violent mental emotion, whether terror, grief, or joy. Mental overwork can excite *per se* brain conditions of a dangerous nature, such as hyperæmia or anæmia, and even, it is said, meningitis of simple or tubercular form, according to inherited predisposition." Again, the mind is affected by imitative influences; thus chorea is excited in some individuals by watching choreic movements, and a single hysterical patient may arouse in others symptoms almost identical with her own, while the direct influence of the mental and moral state upon existing disease and in governing the susceptibility to others, is of the most potent character.

Special exciting causes are those which immediately precede the development of disease and give to it a definite form, but yet are not the only ones from which the resulting disease may arise. Most of the causes of this class operate without the aid of any evident predisposition. They include mechanical and chemical causes and poisons. The mechanical causes are very numerous, and include wounds and injuries of the body, obstruction of its natural channels, and such violent over-exertions as can cause hernia, hæmorrhages, as from the vessels of the lungs, cerebral congestions, and even ruptures of the valves of the heart, and, in one or all of these cases, may lead directly to death. Syncope has occurred in the most healthy from violent exertion in hill-climbing, heavy lifting, and in running to catch trains, etc., heart-strain resulting not only in valvular lesions, but acute dilatation of the ventricles most probably occurring. Chemical causes are also numerous, and include all which destroy the natural organization of a part by virtue of chemical affinity. Metals and other substances at a high temperature; br

ing liquids and caustics, whether solid or liquid, acid, alkaline, or saline, act in this manner. Some of them, like corrosive sublimate and the arsenical preparations, from their usually producing their effects after being taken internally, are ranked among the poisons. Taken in this way, they produce disease in one of two ways. If in large doses, they prove injurious or fatal by their direct action upon the tissues of the stomach, which they destroy chemically; if in smaller doses and frequently repeated, they prove fatal by injuring one function after another until not enough are left unimpaired to sustain life. Poisonous gases are powerful excitants of disease, and so are poisons generally; whether animal, vegetable, or inorganic, they may destroy life quickly or excite a disease of long-continued, or even of a permanent nature.

The presence of various parasites by mechanical intrusion may also afford an especial exciting cause of disease.

The Specific Causes of Disease.

By specific causes are meant those which not only engender distinct diseases, but which are supposed to be the *only* causes of the maladies which follow their application respectively. Such, at least, is a strict definition of the phrase derived from the phenomena of infectious fevers and inoculable diseases. But some affections, which are ordinarily supposed to arise from a particular cause, and from that alone, do in exceptional cases proceed from another cause. Thus several diseases, whose rule of propagation is from individual to individual, in exceptional cases appear to be spontaneously generated, and, still more, upon the other hand, those which seem to be of atmospheric origin are at times unequivocally disseminated by contagion. The so-called "specific" cause of disease has ever been one of the most puzzling questions with which the human mind has had to grapple. Thus, for example, we know nothing yet as to the specific poison, if we may so call it, which produces scarlatina, yellow fever, or cholera. The chemist can not detect in the atmosphere the cause of those infectious diseases which spread only through this medium or chiefly in this way, nor can he with certainty detect any peculiar substance in the blood of the most pestilential malady other than that from the contamination of defective excretions. Neither by the microscope nor by the minutest chemical analysis can we distinguish the pus globule of small-pox or of syphilis from the most laudable pus of the surgeon. Nor has the most delicate tests as yet shown anything especially distinctive in the saliva of a rabid animal by which specific diseases of this class are communicated so certainly and positively by direct contact. The "*materies morbi*" of these diseases, in our present state of knowledge, is still an unsettled problem. It is true the advocates of the "*contagium-vivum*" theory of disease claim to have demonstrated the specific cause of three diseases (splenic and relapsing fever and tuberculosis), but the medical profession is not disposed to receive as admitted fact that which is as yet but simple conjecture. At all events, in the vast majority of infectious and contagious diseases the poisons by which they are called into activity are as yet unseen and unknown. It is true that microscopical observers all admit the frequent, if not constant, occurrence of bacteria in most epidemic diseases, but, unfortunately for the settlement of these questions, are far from agreed as to the pathological importance of these organisms, many believing them to be the result and not the cause of morbid conditions; but the further consideration of specific causes of disease will be considered under the head of zymosis and contagion.

Zymosis is a term used in speculative pathology to denote the action of a peculiar and little-known process analogous to fermentation. According to the views of some, a zymotic change of the blood in epidemic, endemic, and infectious or contagious diseases is due to *catalysis*, or continuous molecular n; for example, a decomposing organic molecule is introduced into the n body, and, by a law of catalysis, induction, or contact, this molecule or

germ imparts its own motions to other molecules with which it may come in contact. Chemists have defined this change to be "decomposition by contact," or the "action of presence." The term zymosis was introduced by the late Dr. William Farr, Registrar-General of England, and embraces that morbid change in the blood which characterizes those epidemic, endemic, and contagious diseases which are enumerated toward the close of this article. "An illustration of this law is the power which small quantities of certain substances possess of causing unlimited quantities to pass into the same state. Other analogies are the diffusion of heat from molecule to molecule, the phenomena of crystallization, or the solution of an alloy of platinum and silver in nitric acid, when the platinum, which under ordinary circumstances is insoluble in nitric acid, takes on the action which is transmitted through the atoms of silver. A more remote analogy is the extension of a conflagration to surrounding combustibles. An illustration more to the point is the molecular motion that takes place in the operation of skin-grafting. As has been stated, we are still ignorant of the different viruses, contagions, poisons, miasmata, etc., but it can be shown, in attempting to trace some of their phenomena, that the introduction of putrid or contagious matter into the animal system gives rise to factitious diseases having all the characteristics of essential fevers. The following observations have been adduced in reference to this point: Subjects in anatomical theatres frequently pass into a state of decomposition which is communicated to the blood of the living body. Putrefying blood, brain, eggs, etc., laid on recent wounds, cause vomiting, lassitude, and death, after a longer or shorter interval. Numerous experiments have demonstrated that putrid matter injected into the blood of healthy animals gives rise to a set of symptoms analogous to typhus fever. Injecting yeast or sugar into the circulation excites many of the ordinary kinds of fermentation, giving rise to a disease like typhoid fever. A universal observation is that the origin of epidemics is often to be traced to the putrefaction of large quantities of animal and vegetable matters; that miasmatic diseases are endemic in places where the decomposition of organic matter is constantly taking place, as in marshy and moist localities; that they are developed epidemically under the same circumstances after inundations, and also in places where a large number of people are crowded together with insufficient ventilation, as in ships, prisons, and besieged places. Factitious fevers, produced by the introduction of deleterious substances directly into the blood, are analogous, both in their symptoms and pathological lesions, to those produced by the sting or bite of certain animals; they present also the same general class of symptoms that are present in small-pox, scarlatina, and other eruptive diseases. Putrid animal exhalations have given rise to diseases that have raged like a pestilence or epidemic. Measles can be communicated by means of a drop of blood from a patient affected with the disease; the inoculation of an unprotected person with small-pox may be the means of giving the disease to thousands, and a mere trace of serum is sufficient to propagate cattle plague." The *rationale* of the word "contagion," as now used, is that the property is understood to attach itself essentially to a material *contact*, but does not necessarily imply that, when infection is spread from individual to individual, the contact of the individuals must have been *immediate*, but that in all cases there must have been passage of material from the one to the other as was in itself at least a *mediate contact* between them. "The true or *metabolic contagia*, which in their respective and specific ways operate *transformingly* on the live bodily material which they affect, are (after acquired predisposition to disease from defective hygiene), perhaps, the most important of all the incidental physical influences which concern mankind." The identity of each separate true contagium has been *assumed* in experimental and clinical observation by the uniformity of the operation of such on any given animal body which it effects. The circumstances which have rendered the *contagium-vivum* theory of disease plausible is that each of the infectious diseases appears, as a rule, to propagate itself in almost as exact identity as if it were a species in zoölogy or b

and in each such repetition of the disease there is a multiplication of *material* which has the same infective property. Evidence of this effect is to be observed in cases of small-pox, measles, scarlatina, whooping-cough, enteric fever, mumps, typhus, syphilis, cow-pox, diphtheria, erysipelas, hospital gangrene, purulent ophthalmia, venereal soft chancre, and phagedæna, etc., although such diseases may, and sometimes do, blend and merge one into the other in exceptional cases, yet, as a rule, one rarely sees any one of these diseases produced by the contagium of another, and any man who has before him a case of one of them can see that, however minute may have been the quantity of contagium by which the disease was started, the patient's diseased body, part or whole, yields for the time an indefinitely large supply of the so-called "specific" agent. It should be remembered, however, that it is more or less habitual to some of the diseases that the infectedness of the patient is first made known to the observer by such *general pyrexia* as tells of a change already far advanced in the circulating mass of blood; and it is only after this has shown itself that other symptoms, adding themselves to the fever, complete the more or less complex type which establishes the identity of the disease. "But in the physiology of the metabolic contagia no facts are more characteristic or more important than those which show the *relativeness* of particular contagia to *particular receptivities* of body. First, and in intimate connection, as would seem, with a *chemical electiveness* of action, there is the preference which some particular contagia (however introduced into the system) show for particular *organs* of the body; so that by the exercise of this preference there is given to each of the diseases its own set of clinical and anatomical characters. Compare as instances in this point of view the respective local affinities of small-pox, enteric fever, mumps, syphilis, and hydrophobia. Secondly, it may be noted that, in regard to some of the contagia, different *persons*, and particular persons of different *family stocks*, show original differences of susceptibility; original, namely, as distinguished from others which are acquired; so that, for instance, the severity with which scarlatina or diphtheria will strike in particular families contrasts with a comparative mildness of the same disease in other families, or perhaps even with cases of *apparently complete personal immunity under exposure to the particular danger*. And recent researches have seemed to suggest as possible that, in the very wide differences of degree with which tubercular disease prevails in different families, an essential condition may be that the families have widely different degrees of *original predisposition* toward the septic contagia in general. Thirdly, there is the extremely suggestive fact, with regard to many of our best-known febrilizing contagia, that they run a course of *definite duration*, and that in this course, provided the patients do not die, all present, perhaps all future, *susceptibility to the particular contagium is utterly exhausted from the patient*; so that reintroduction of the same contagium will no more renew that patient's disease than yeast will excite a new alcoholic fermentation in any previously well-fermented bread or wine. The inference from this fact seems unavoidable that each such contagium operates with a chemical distinctiveness of elective affinity on some chemical ingredient or ingredients of the body (which may happen to be present), and that exhausting this particular material in febrile process, which necessarily ends when the exhaustion is complete, is the bodily change which the contagium 'specifically' performs. Of not all metabolic contagia, however, can it be said that their operation runs so definite and self-completing a course. For, first, there are particular *acute affections* which as a rule kill, either (as appears to be the case in splenic fever when affecting man) because of the extreme magnitude of the transforming process which the contagium sets up, or else (as appears to be the case in hydrophobia) because the elective incidence of the contagium is on an organ indispensable to life, so that in such cases there is in fact hardly such an event as passing alive through the whole process of the disease. And, secondly, there are the *contagious dyscrasies*, which are clearly characterized by their tendency to recur, and to indefinite ...tion: syphilis, which oftener than not relapses in successive outbreaks,

and often, as years pass, invades the body more and more deeply; and tubercle and cancer, with almost invariable persistence, will in general steadily advance, month by month, to infect more and more of the body till the process eventuates in death.

"The transmission of various contagious diseases in *communities* is, of course, greatly influenced, both in detail and in aggregate, by such differences of individual receptivity as were mentioned in the last section. Notably, as regards communities through which particular acute infections have had full run, fresh sparks of the contagium may find little or no fuel on which to act, and much new diffusion of the disease may not again be possible till emigration, or birth, or lapse of time, operating in other ways, shall have reconstituted a susceptible population. And in a given susceptible population circumstances of time and place are infinitely various (especially as to quantity and quickness of personal or quasi-personal intercourse) in determining how far this population shall have particular contagia thrown in its way. Also there are conditions, not primarily of a personal kind, which operate on a very large scale in determining the spread of some metabolic infections, giving to them, respectively, *at certain times*, in ways not hitherto understood, a *special increment of spreading power*, and in some instances also *special malignity*; and thus enabling them, respectively, from time to time, to come into comparative prominence in national life, and perhaps at once or successively, in many different countries, in the form of the so-called *epidemics*, because great numbers of people may be attacked within a short period of time." In this way, medical history tells us, they have distinguished one country from another, one year from another, and have proved epochs in chronology; and, as Niebuhr has shown, have influenced not only the fate of cities such as Athens and Florence, but of empires; "they decimate armies, disable fleets; they take the lives of criminals that justice has not condemned; they redouble the dangers of crowded hospitals; they infest the habitations of the poor, and strike the artisan in his strength down from comfort into helpless poverty; they carry away the infant from the mother's breast, and the old man at the end of life; but their direst eruptions are often excessively fatal to man in the prime and vigor of age." In reference to this subject, Dr. Simon, of London, remarks that it is a matter of familiar knowledge that the fevers which are most habitual to England—scarlatina, measles, small-pox, and enteric fever—are of nothing like uniform prevalence; that scarlatina, for instance, will be three times as fatal in one year as in another, and that small-pox is liable even to greater exacerbations; and it is known that temporary differences of this kind are not exclusively local; that (quoting, for instance, from an official report of recent date) "the epidemic of small-pox which began in England toward the close of 1870, and terminated in the second quarter of 1873, was part of a general epidemic outbreak of that disease of world-wide diffusion, marked wherever it occurred by an intensity and magnity unequaled by any previous epidemic of the disease within living memory." The wider the survey which we take of epidemiology, the more certain it becomes to us that, outside the conditions which are independently personal or local, there are *cosmical conditions* which have to be considered. Doubtless there are great epidemiological facts—such, for instance, as the first spreading of small-pox to America, or in our own times the increasing frequency of Asiatic cholera in Europe and in this country, which may be ascribed to novel conditions of international intercourse; but there are others equally great to which, apparently, no such explanations can be applied. For what reason is it that cholera every few years has its definite fit of extension in India? Or why diphtheria, which scarcely had a place in history till it overran Europe in the sixteenth century, and which, since then had been rarely spoken of, began again some twenty odd years ago, to be comparatively important in England and throughout the world? Or why the plague of the Levant has for the last two centuries been so unfamiliar to us? Or why the yellow fever of the Mississippi has in particular years raged furiously in parts of Europe and in certain cities of the United States far beyond its natural boundaries? Or why

the black death of the fourteenth century, though apparently still surviving in India, has never but that once been in Europe? Or whither has gone the sweating sickness of England that prevailed three centuries ago? Or whence have come the modern epidemics of cerebro-spinal meningitis? These and many like questions, which can not at present be answered, seem to be evidence enough that, in the making of epidemics, contagion and personal susceptibility may be factors in a partly *conditional* sense. Influences which are called "atmospheric"—the various direct and indirect influences which attach to the normal succession and occasional abnormality of seasons, in respect of the isolation of our planet, and of the temperature and humidity of air and earth—are in general far too vaguely regarded as elements of interest in the present question, but are possible factors which no one who tries to solve these problems should omit from scientific consideration. In the passage of the metabolic contagia *from person to person*, various agencies may be instrumental—bedding, or clothing, or towels which have been used by the sick, dirty hands, dirty instruments or other utensils, the washer-woman's basket, foul water-supply, stinking house-drains, contaminated milk or other food, the common atmosphere; but differences of that sort are only differences as to the *means by which such communication is established with a diseased body*, as brings its products into relation with healthy persons, and the disengagement of *infectious products* from the bodies of the sick is, pathologically, the one influential fact. As regards the products which ought to be deemed infectious, the specially diseased surfaces and organs of the patient, and the discharges and exhalations which they respectively yield, must always be regarded with chief suspicion; but suspicion, however much it may insist on them, must never disregard other sources of danger." Presumption against every part and product of the diseased body is by every one readily admitted where there are well-marked general symptoms of disease; but it is important to know that not only in such febrile states, but even in states of chronic dyscrasia, and even at times when dyscrasia may be giving no outward sign, the infected body may be variously infective. Thus, in regard to constitutional syphilis, Dr. Simon says it is certain that the mere utero-catarrhal discharge of the syphilitic woman, or the sperm of the syphilitic man, or the vaccine lymph of the syphilitic infant, may possibly contain the syphilitic contagium in full vigor. Even at moments when the patient thus shows himself infective, he has not on his own person any outward activity of syphilis. Similarly in regard to tubercular disease: experiment has proved beyond question that the milk of animals suffering from tubercle will, if taken as food by other animals, infect them through the intestinal mucous membrane; and there are independent reasons for believing that the tubercular contagium (like the syphilitic) will at times during the dyscrasia be contained in the seminal fluid, and that men tubercular, perhaps only in some degree, which is not immediately important to themselves, may by that secretion convey fatal infection to women with whom they have conjugal relations. With regard to many of the metabolic contagia, conclusive evidence exists that, when they are in operation in pregnant women, the fœtus will generally be infected by them. This is notably true of syphilis, small-pox, and cholera. "In general, the contagium of each infectious disease has its own favorite way or ways of entering the body, which are not only of speculative interest, but of obvious practical importance as measures of the widely different degrees in which the different infectious maladies are qualified to spread in communities. Thus *inoculation at broken surfaces* of skin or mucous membrane has long been known as the ordinary mode by which the infection of syphilis, hydrophobia, splenic fever, cow-pox, and farcy or glanders, get admission to the body, and our best knowledge of some other infectious diseases (notably of tubercle) has been derived from inoculations intentionally made with their contagia for purposes of study. While probably all infections which tend to be of general action on the body can be brought into development in that way upon individuals susceptible of their influence, and while some infections e not known to pass by any other mode of transmission, there are many

infections which spread freely from subject to subject by 'atmospheric and dietetic communication.' It may be presumed that in the modes which are not by true inoculation, acts which are comparable to inoculation take place on internal surfaces; that, for instance, when particles of scarlatina contagium are caught in the tonsils, or inhaled into the bronchi, or swallowed into the stomach, they begin by penetrating the texture of the mucous membrane, and by thus affecting as real inoculation with regard to the blood as that which art or accident provides in other cases through the punctured skin. That previous abnormal breach of surface by artificial puncture or otherwise is not necessary to allow the infection of mucous surfaces, is illustrated in ophthalmia and gonorrhœa, where apparently no other condition has been fulfilled than that a particle of the blennorrhagic contagium shall be deposited upon the natural surfaces of the mucous membrane. It deserves notice that while a considerable number of the worst diseases of the domestic animals admit of being communicated to man by artificial inoculation, atmospheric communication seems to be very inapt, if not absolutely unable, to infect man with any one of them; and in this connection it may be of interest to remember that syphilis, one of the most familiar of human infections, but hitherto not traced to any brute ancestry, differs from our other current infections in requiring inoculation to transmit it."

When any metabolic contagium enters the animal body, it requires an *interval of time*, and in most cases a considerable interval, before its morbific effects can become manifest even to skilled observation. "The period of latency, or so-called *incubation*, varies greatly in different cases. In hydrophobia it is very rarely less than of one month, is certainly often of several months, and is said to be sometimes of years. In syphilis the inoculated spot remains generally for at least a fortnight, and may remain even as much as five weeks, without any ostensible change; and the roseola of the general infection will not be seen until some weeks later, when generally at least three months will have elapsed since the first inoculation. In the acute eruptive fevers, when their contagion is transmitted by air, the first changes which ensue on infection are not external, and we can not be sure what early internal changes may take place; but, in small-pox, the fever (which is the first overt sign) does not attract notice until about the twelfth day after infection, nor the eruption until two days later; and in measles the incubation-time, though perhaps less uniform, seems to be little (if any) shorter than small-pox." The septic contagia seem to be of particularly quick operation; but even that of the most virulent character, without complications, will not begin sensibly to derange the infected individual till at least several hours after inoculation.

Recent researches into the peculiar nature and origin of the specific poison or "disease germ" of infectious maladies have not done much toward elucidating the question. "Spectroscopic examination of the contagious fluids, variations of temperature, symptoms of the patient, anatomical alterations and microscopic and chemical study of the blood upon the living and the dead, have furnished no notions sufficiently precise to draw any practical deductions." The most widely prevailing doctrine of the present day respecting the origin and communication of disease is that known as the "*germ theory.*" Special organic forms, known as microzymes, bacteria, bioplasts, etc., alleged by various pathologists to be found in contagious fluids, have been the subject of much discussion, some contending that they are of fungoid growth and enter the body as parasites; others, that they are germinal masses derived from normal cells, and due to a series of changes in existing matter under new circumstances; while a third class deny positively that any such germs exist. The advocates of the "germ theory" believe that low, self-multiplying, organic forms, specific in each case for the particular disease which is in question, are essential to each morbid poison; that the increase of each contagium as it acts is the self-multiplication of a *living thing;* and that this (however obscure may yet remain its mode of operation) is the *essential originator of change* in the affected mat-

rials of the diseased body. But, unfortunately for this theory, such forms have been found when no disease existed, and in some of the most infectious maladies their presence has not been demonstrated. And granting the fact, says Bastian, that low organic forms of the sorts referred to have often or generally been seen in the morbid products and tissues of persons with zymotic disease, this would not by itself be a proof, or nearly a proof, that the forms are causative of the morbid change, for obviously they might be mere attendants on the necrosis and decomposition of bodily material, availing themselves of the process (just as certain insects would) to feed and multiply; and in many of the cases in which micrococci have been seen in morbid material no direct proof can be given that the meaning of their presence is more than this. The advocates of the "germ theory" assume that an infectious disease *can only* spread from part to part or from person to person in communities through the agency of these low, self-multiplying, organic forms. But in the spread of morbid processes from part to part, as during the "generalization" of some malignant new growth, the agency of "germs of disease" is probably more imaginary than real. Results are apt to be ascribed to "infection" where nothing of the kind has been in operation—as when similar perverted tissue changes may chance to manifest themselves, either simultaneously or consecutively, in different parts of the body as results of some single or similar underlying cause. And in the spread from person to person of local or general contagious affections, the same possible source of fallacy has to be borne in mind. In connection with this subject, Bastian remarks that we must be on our guard against ascribing too general an influence to "germs of disease." For, in certain cases, these may have been, in the first place, non-existent, as when such a disease has been "*autogenetic*," and in no sense a derivative of antecedent disease of the same kind. This caution is especially applicable in regard to such an affection as erysipelas, which, although certainly contagious, is also, on very good grounds, judged to be generable, especially during certain states of lowered health induced by renal disease and some other visceral affections. Though not so certainly known, it is by many deemed probable that a similar caution may be necessary in regard to more general contagious affections, such as diphtheria, typhoid and typhus fevers, and cholera, which, though certainly contagious, may also be autogenetic. Among these diseases we might still mention several others, which, although their ordinary or normal mode of spreading is by contagion, yet, beyond reasonable doubt, do sometimes arise spontaneously; this is the case with scarlet fever, yellow fever, small-pox, gonorrhœa, rabies, and glanders, the two last, in fact, being only of spontaneous origin in the lower animals, from which they are communicated to man. It would appear from the conclusions of Bastian that in those complex, prolonged, and continuous morbid processes constituting the phenomena typical of some particular infectious malady—that at some stage of this complicated chain of processes, and somewhere (that is, either in some organ or tissue, or in the blood), certain organisms may arise *de novo* which, either alone or with their parent fluids or tissue elements, may be capable of acting as contagia. But the organisms in such a case could not be regarded as direct descendants of pre-existent organisms, any more than we would regard the pus corpuscles met with in a case of purulent ophthalmia or gonorrhœa as direct lineal descendants of those which may have taken part in occasioning one or other of such diseases. "In the event of its being true, as some hold, that certain living organisms are met with in the blood, such as bacilli, micrococci, etc., which are believed to be at times the causes of certain of the communicable diseases, but which may arise independently within the body (from a depraved and altered condition of the blood and excretions incident to disease) by the process of 'heterogenesis' or by 'archabiosis,' then it is clear that their assumed mode of operation in the causation of disease is erroneous, and that their influence in the transmission of disease is simply that of carriers of contagion, the same as not-living chemical compounds and off and altered tissue elements. In the spread of local affections, such as

ophthalmias, gonorrhœas, and erysipelatous inflammations, chemical compounds or diseased tissue elements, or both in combination, thrown off from such foci of disease and falling upon suitable situations in other human beings, are capable of determining inflammations of like kind, in which multitudes of new contagia, also of like kinds, are 'independently' produced—that is, are produced otherwise than by process of organic reproduction. How far such chemical or 'contact' actions (not necessarily producing inflammation) may take part in and underlie the very complex group of morbid processes constituting this or that general contagious affection, or so-called 'specific fever,' is not yet known. The processes must be somewhat of this kind if the operating contagia are not living organisms; and even where they are of this type, it is possible that the same sort of process may obtain."

It is not yet possible to say with regard to the metabolic contagia what is the *essential constitution* of "contagious matter," or what the intimate nature of the transforming power which the particle of such matter exercises on the particles which it infects. Nor are we able, by actual demonstration, to say that contagion is a *material substance*. We know that the ancients, in investigating the nature of *heat*, regarded it at first as a kind of subtile matter which insinuates itself into the substances of bodies, and resides there with greater or less manifestation of its presence; but that heat is now regarded and proved by scientific observers to be not a material substance, but simply a *condition of matter*, a *force*, or a molecular motion; and, from the nature of its action, *contagion*, like the *force* caloric, appears to us to be a mere *condition* of matter, and not a material substance. As regards the question of *force*, which may explain the transforming power of the metabolic contagia, science is still ignorant. Yet expert chemists express clearly enough the conviction that a certain great force in nature lies beyond their power, even of definite nomenclature, much more of exact identification and measurement. But in that most interesting, but most difficult, and hitherto almost uninvestigated branch of chemical dynamics, we are supposed to have our nearest clew to the scientific problems connected with the subject under consideration. Hence any theory which tends toward a more clear explanation of the *rationale* of these processes becomes a matter of great interest. The theory which we present assumes the identity of the physical and vital forces. The physical forces embrace magnetism, chemical affinity, heat, electricity, and motion. The so-called vital forces are assimilation, combustion, animal heat, nerve-force, and muscular contractility. All scientists now concede the correlation of the physical forces, that they are all convertible the one into the other, and that force, like matter in any form, can neither be created nor destroyed, and, as presented to us in the universe, they are both indestructible and inseparable, perpetually existing and unchanging in quantity, yet ever changing in form. The ultimate nature of force, however, is the greatest mystery of nature. Visible only in its effects as revealed to our senses, it becomes at once an unknown and an unknowable power, transcending all human knowledge and conception. We can only judge of its essence, therefore, by the peculiarity of its action and the effects which it produces. If we accept the teaching of modern science, all matter is the vehicle of change, motion the result of change, and *force* the cause of change. Life, as we understand it, depends upon the presence of a material substance operated upon by force resulting in movement, and the harmonious interaction of these conditions, when applied to the animal body, would not only constitute life, but health—while its derangement would as surely eventuate in disease and death.

According to the demonstrations and conclusions of modern investigators in physical science, the "*vis viva*," or life-force, is simply the combined influence of the physical forces which is constantly changing its form in the so-called vital processes, while its supply is maintained by the food we eat, the fluids we drink, and the air we breathe. Thus, for example, the nutrient fluid charged with oxygen is placed in an electro-positive condition; at the same time the tissues are in an electro-negative or magnetic condition, by

which assimilation or chemical affinity is induced; this involves combustion, oxidation, and molecular motion. Molecular motion is converted into (animal) heat, and heat is converted into (animal) electricity or nerve-force, and nerve-force induces muscular contraction or mechanical motion, which in turn serves to assist and perpetuate the operation of the other forces, in that it maintains the respiratory function, contracts the heart and arteries, propelling the blood to all parts of the system, and thus supply tissue-waste, equalize temperature, and maintain the secretory and excretory functions of the body. Such are the different manifestations of the so-called "*vital forces*," the harmonious and normal operations of which constitute life and health, but, when perverted, will not only occasion disease and disorganization, but death, either local or general, as conditions may determine. To illustrate: if the blood from any cause becomes contaminated or deficient in oxygen, the forces governing nutrition, such as assimilation and combustion, will be perverted in their operation, waste material, or *materies morbi*, will be developed, which may eventuate in morbific effects, such as malnutrition and disorganization of tissue of various degrees and varieties, according to the natural or acquired susceptibility of the subject. Or, the *materies morbi* thus accumulated may remain in a latent condition until equilibration is commenced by increased oxygenation, and then the increased oxidation augments the amount of animal heat within the body, causing fever, which may in its turn induce pathological lesions, which may vary in character with its intensity, ten degrees of which mark the difference between life and death. Force can only manifest itself by molecular motion, but it may exist in two general forms, known as potential energy and actual energy. Force stored up in certain conditions of matter, as in the tension of the particles of an explosive compound, such as nitro-glycerine, or in a combustible body, such as wood, coal, and food of animals, is called potential energy—that is, power capable of being liberated for the production of effects. But, when the nitro-glycerine explodes, the fuel is burned, or the food is oxidized in the animal body, the force they contain is given out in the form of effects produced, and the potential energy becomes actual energy, or, in animal bodies, living force. Such is the nature of unoxygenized material in the blood, constituting *materies morbi* in that it represents potential energy—becoming actual energy producing morbid effects when subjected to zymotic action.

Force, acting upon different forms of material substance, will manifest itself in different ways—as chemical affinity, combustion, electricity, heat, etc. Also, force in its different forms, acting upon the same material substance, may give rise to a multiplicity of effects, as quantity and local conditions may determine. *But force, operating in a certain direction, producing certain results, tends to continue in that direction and in the production of the same results so long as conditions favorable to its action obtain*; thus the molecular motion imparted to a conducting wire from a galvanic battery may continue for thousands of miles; a spark of fire may destroy a city; and so the smallest quantity of chemical force arising from the blood in a state of zymosis, conveyed by means of its own elements, may set up the same morbid action in other individuals whenever their blood becomes of a suitable zymotic condition, and it is the operation of this law that gives us the *rationale* of contagion. But we find—as in the physical forces, so in the vital forces; as in the great laboratory of nature, so in the individual organism—that action is met by counter-action, and that force, however manifested, sooner or later tends to equilibration. For this reason galvanic batteries become exhausted, fires must be fed with fuel, and zymosis ceases and disease ends in the affected individual and in communities when the material suitable for its action has been extinguished. Strictly speaking, therefore, contagion is a *morbid influence*, and does not imply the existence of animated germs any more than that of any other vehicle, vital or otherwise, which may serve to convey zymotic action. The essence of contagion is not a material substance, but force, imponderable in its nature, as heat, light, or electricity. Specific only so far as it naturally tends to operate in the same direction

upon the blood of another individual, when it contains certain constituents of identical character with those upon which it has been operating in the blood of the infecting individual.

And it appears reasonable that the "specific" or determining causes of infectious disease involve an acquired personal predisposition for their development, an essential condition of which is the accumulation of azotized or unoxygenized material within the blood, due to defective excretion or other causes; and if such material be retained in the system a sufficient length of time and exist in sufficient quantity, it may itself assume a state of change, or induce a condition of change in the normal cell elements of the blood, and thus give rise to an autogenetic origin of disease, which, when of sufficient virulence, may reproduce the disease by *contagion of zymosis* in another individual, provided his blood is in a similar unhealthy condition, which is likely to be the case when individuals and communities are alike subjected to the same general and special predisposing causes of disease. And it would seem possible that while the force zymosis generally induces disease identical to that from which it originates, it might yet establish a zymotic action sufficient to engender other diseases, and, in case we assume the nature of zymotic force to be common to all of the infectious maladies, still, its effects would differ as other factors might determine. Thus the degree of virulence and the types and varieties of infectious disease would then depend upon the present condition of the individual, his powers of constitution, age, susceptibility, weakened condition of certain organs or tissues from previous disease, or tolerance from like causes, as well as the character of the defective excretion, its degree, and the impression it has made upon the nervous system and nutritive functions, and also the route or channel by which nature attempts its elimination, as influenced by that elective attraction or repulsion which one tissue or part of the body may have in excess over another for *materies morbi* in the blood. And for these reasons it would be possible, with a common contagion and common blood contamination, for one individual to be attacked with one form of infectious disease, and *one* another, during the prevalence of a special epidemic, and thus afford an explanation of the tendencies of certain maladies to diversify in their characters, but also of those of different classes, to occasionally blend and merge the one into the other, as well as of the development of complications in individual cases—facts observed, but not otherwise easily accounted for.

In conclusion, it may be stated that the term *zymotic* has been admitted into standard medical nomenclature as conveniently expressive of the elements or factors giving rise to many of the conditions incident to infectious disease, and is therefore employed to designate all that class of diseases which can be communicated from existing foci, and which are capable of being prevented by hygienic and other conditions. The latest and most approved nosology includes about twenty of our principal diseases in the zymotic class: such as small-pox, measles, scarlet fever, diphtheria, croup, whooping-cough, the *essential* fevers (including typhus, typhoid, cerebro-spinal fever, yellow fever, and the different forms of so-called malarial fever), quinsy, erysipelas, puerperal fever, carbuncle, influenza, dysentery, diarrhœa, cholera, rheumatism, etc.

The reports of the Registrar-General of England show that about one fourth of the whole number of deaths is from zymotic disorders. An examination of the returns of the Surgeon-General and of the Marine Hospital Bureau, as well as the health reports from the principal cities in the United States, will establish about the same ratio. This immense mortality, in view of the fact that all zymotic diseases are preventable, enforces the necessity of sanitary precautions.

GENERAL PATHOLOGICAL ANATOMY.

The subjects embraced in general pathological anatomy may be classified and considered under the following headings: 1. General pathology of the

blood. 2. Local disturbances of the circulation. 3. Active alterations of the solid tissues. 4. Passive alterations of the solid tissues.

Morbid Conditions of the Blood.

The character, composition, and functions of the blood are sufficiently familiar, and do not require to be described in the limits of this work. But certain facts connected with the *physiology* of this fluid have a special bearing upon its *pathology*, and should be briefly considered before its morbid states can be profitably discussed.

Physiology of the Blood.—" The *red corpuscles* of the blood consist of two portions—a colorless, sponge-like matrix, and a colored substance of complex composition, which occupies the interstices of the former and accurately fills them. The matrix is regarded as possessing chiefly physical properties, while its contents constitute the active part of the corpuscle, and consist of hæmoglobin. The *source* of the red corpuscles is of the greatest pathological importance. In the embryo the blood and the blood-vessels are developed from the same elements, and thus the two structures, in their physiological aspect, are essentially inseparable. In fully developed blood the source of the red corpuscles is obscure. They are supposed to originate from the colorless corpuscles, and more remotely from the lymphatic glands, the spleen, and the medulla of bones; but light is of the greatest importance as regards the formation of hæmoglobin. With respect to the properties and *function* of the red corpuscles, it is to be noted that the ultimate elements of hæmoglobin are carbon, nitrogen, hydrogen, oxygen, sulphur, and iron—the last of them probably being the cause of its red color. Hæmoglobin is soluble in water, forming a lake liquid, from which fine crystals may be obtained, and which may be variously decomposed, giving rise to other blood-crystals. The most important property of hæmoglobin is its tendency to combine with certain gases to form definite compounds—with O to form oxyhæmoglobin; CO to form carbonic-oxide hæmoglobin; and with N_2O to form nitrous-oxide hæmoglobin. These compounds, and especially the oxyhæmoglobin, are exceedingly unstable, being reduced, even under very feeble influences, to hæmoglobin, and their other constituents respectively. Alternate oxidation of hæmoglobin and deoxidation of oxyhæmoglobin are constantly going on within the red corpuscles of the circulating blood—its oxygenating or respiratory function. The volume of oxygen in arterial blood is about seventeen per cent, and in venous blood about six per cent. It should be clearly understood that disorders connected with the red corpuscles (or respiratory elements of the body), whether in amount, composition, or circulation, directly affect the oxidation processes only. Besides their origin and their function, there is a third relation of the red corpuscles to the organism—namely, that of their *products*. These are eliminated by the ordinary channels, the salts, which are chiefly salts of potash, being excreted by the kidneys, and their colored material furnishing the pigments of the bile and urine.

" *The white or colorless corpuscles* of the blood, also called *leucocytes*, are chiefly derived from the corpuscles of the lymph and the cells of the lymphatic glands and allied organs, which they closely resemble. By escaping through the walls of the blood-vessels, they become identical with the wandering cells of the tissues, and with pus corpuscles—from which they are indistinguishable except by locality. Such is the origin, and such are some of the functions, of the white corpuscles. Their occasional development into the red corpuscles has been already mentioned. It might, therefore, be expected that morbid states of the leucocytes would be associated with disorders of the lymphatic structures and connective tissues, of the red corpuscles, and of the blood-vessels, as will hereafter be shown to be the case. The proportion of white corpuscles in the blood is subject to physiological increase, without becoming excessive, as after meals, during periods of growth and development, and in menstruation and pregnancy. This state has been termed by irchow *physiological leucocytosis*, and signifies lymph-glandular excitement.

Plasma of the Blood.—"The physiological relations of the plasma to the organism are extremely complex; and disturbance of these relations furnishes many of the symptoms of disorders of the blood. Its mature *function* is essentially one of nutrition; it evolves the lymphoid cells, and supplies the tissues with oxidizable material for development, growth, support, secretion, and the liberation of force. The *source* of the plasma is equally extensive. It derives its principal constituents from the alimentary canal through the absorbent glands and liver, while other important albuminous substances are being constantly supplied from the tissues generally through the lymphatic system. Lastly, the *products* of the plasma, such as carbonic acid, urea, and water, are discharged by the regular excretory channels. Thus the condition of the plasma is found to be most intimately associated with that of the organs and tissues generally, whether as regards its origin, its mature function, or its products, and it will, therefore, be affected by disorder or disease of every organ, whether alimentary, sanguifacient, or excretory, as well as those of all the tissues."

Fibrin; Coagulation of the Blood.—Under certain circumstances, especially after removal from the body, the blood coagulates, and fibrin separates more or less completely from the other constituents. "This change is now believed to be due to the action of three bodies contained in the plasma—two fibrin-generators, named, respectively, fibrinogen, and fibrinoplastic substance, albuminous in nature; and the third a ferment. The *amount* of fibrin produced varies not only with the amount of these bodies, but with the amount of salts, with the degree of alkalinity and of heat, and with other influences; and these variations are subject to no law at present known. The *rapidity* of the process depends upon (1) the amount of ferment; (2) its increased activity by agitation of the blood and by elevation of temperature; and (3) the increased number of points of contact (so-called 'catalytic' action), by the presence of red corpuscles, hæmoglobin, or foreign material, etc. It thus appears that the expressions 'amount of fibrin' and 'rapidity of coagulation,' however important as facts, do not afford any definite indication of the state of the blood, as has been hitherto generally believed. Three essential factors, and a large number of accidental influences, share in the process; they may do so in very various proportions and degrees; they do not vary together; the amount of fibrin is not in proportion to any one of them; and, after coagulation is complete, portions of all the factors probably remain uncombined. The part played by the red corpuscles in coagulation is a double one—(1) the corpuscles, as 'points of contact,' greatly increase the rapidity of coagulation, and (2) they supply oxygen, which appears to be indispensable to the process. The leucocytes probably produce the ferment."

General Pathology of the Blood.

The morbid conditions to be considered under this heading embrace alterations in the quantity or in the quality of the entire mass of the blood. Alterations of the blood may affect, severally or combined, the corpuscular elements, the water, the organic ingredients of the plasma, namely, albumen and fibrin-generators, the gases, and the inorganic salts. Morbid conditions of the blood, due to the introduction of substances not entering into its normal composition, are also to be included in the consideration of its general pathology.

Plethora signifies an increase either in the total amount of blood or in the number of red-blood corpuscles beyond the healthy limit. "The former of these conditions constitutes *polyæmia*, the latter *polycythæmia*. There is no proof that the symptoms hitherto embraced under the name plethora depend upon either polyæmia or polycythæmia. It has been suggested that their cause is to be found in impaired function of the vaso-motor nerves, the regulators of the circulation."

Anæmia.—"Under the name general anæmia are included diminution in the mass of the blood, or *oligæmia;* diminution in the number of red-blood

corpuscles, or *oligocythæmia;* and diminution in the amount of hæmoglobin in the red-blood corpuscles, or *achroiccythæmia.* In many cases of anæmia some of the red corpuscles are much reduced in size. These small corpuscles are called *microcytes,* and the condition of the blood containing them is called *microcythæmia.* These microcytes are regarded by some as red-blood corpuscles in process of formation, by others as atrophied or degenerated red corpuscles. Diminution of the solid ingredients of the plasma, especially of albumen, is also an element in most forms of anæmia. But the essential element in anæmia is diminution in the hæmoglobin of the blood. It is to this loss of the coloring matter of the blood that the most obvious and characteristic symptom of anæmia—namely, the pallor—is due. It was formerly believed that the quantity of hæmoglobin in the blood is directly proportioned to the number of red-blood corpuscles, but recent observations have shown that red-blood corpuscles in disease vary in the percentage of hæmoglobin which they contain, so that reduction in the amount of hæmoglobin in the blood does not necessarily involve a corresponding diminution in the number of red corpuscles. Still, a greater or less loss of red-blood corpuscles is an almost constant change in anæmia, and the cases are exceptional in which the extent of this loss is not an approximately correct index of the degree of anæmia. The normal amount of hæmoglobin in the blood is estimated at from twelve to fourteen per cent. This amount may be reduced in anæmia even as low as two per cent. Cases of chlorosis have been observed with the normal number of red corpuscles and with less than half the proper amount of hæmoglobin. The total mass of blood in anæmia is not necessarily reduced out of proportion to the loss of weight of the body except in cases of acute anæmia immediately following hæmorrhage. It may, however, be disproportionately lessened. Cases of progressive pernicious anæmia have been reported in which the quantity of blood was estimated to be four or five per cent of the weight of the body, instead of eight per cent, the normal proportion. If anæmia be severe and chronic, there are produced secondary changes in the organs and tissues of the body. Of these changes none is more important and characteristic than fatty degeneration of the heart. Fatty degeneration of the walls of the vessels of the liver, the kidneys, and sometimes of the voluntary muscles, may also be induced, but in less degree. Ecchymosis and a hæmorrhagic diathesis may be the result of a profound anæmia. Atrophy of different organs of the body is a natural result of long-continued anæmia. It may be noted, however, that anæmia is not incompatible with *embonpoint.* Anæmia may be divided into acute and chronic. The best example of acute anæmia is that produced by copious hæmorrhage. This also affords the purest example of oligæmia. The loss of one half of the entire volume of blood is usually fatal. Females, as a rule, are more tolerant of the loss of blood than males. Infants are especially susceptible to the evil effects of the withdrawal of blood. Under the influence of the vaso-motor nerves, which are affected by anæmia as by an irritant, the vessels adapt themselves within very wide limits to varying amounts of blood without permanent alteration of the blood-pressure. In healthy individuals a very considerable loss of blood is repaired within a short time—at the most in three or four weeks. The blood is very soon restored to its normal volume by the absorption of water. As the red-blood corpuscles and the albumen are not so easily renewed, its specific gravity remains diminished. The white-blood corpuscles are sooner restored than the red. The food restores to the blood its normal amount of albumen.

"The effects of anæmia are grave in proportion to its degree. They are weakness, pallor, coldness of the surface and extremities, rapid pulse, dimness of vision, dyspnœa, muscular spasms, especially in the calves of the legs, and if the loss of blood be sufficient, unconsciousness and epileptiform convulsions from anæmia of the brain. These results are more marked when the hæmorrhage occurs in persons previously healthy than in those already enfeebled. the more chronic forms of anæmia, in addition to pallor of the face and cous membranes, there is usually an impairment of muscular and mental

energy, functional disorders of the nervous system, especially neuralgia and so-called spinal irritation, coldness of the surface, dyspnœa on exertion, impaired digestion, palpitation of the heart, with a pulse either small or full, but compressible.

Hydræmia.—"By *hydræmia* is understood a relative or an absolute increase in the amount of water in the blood in proportion to the solid ingredients. It is the diminution in the amount of albumen which forms the chief element in hydræmia. Less emphasis is laid in this connection upon the loss of blood corpuscles, although, as has been stated, anæmia and hydræmia are usually associated. The salts and extractive matters of the blood are left out of consideration. There are three possible forms of hydræmia: In the *first* the amount of water is normal, but the solids are diminished; in the *second* the solids are normal in quantity, but the amount of water is increased; in the *third* the amount of solids is diminished, but the amount of water is increased. In the third form the highest degree of hydræmia is reached. The various causes of anæmia, involving loss of solid constituents of the blood, are also causes of hydræmia. The most extreme hydræmia is that produced in many cases of chronic nephritis, or Bright's disease, in which there is not only a continual drain of albumen from the blood, but the excretion of water by the kidneys is lessened. In this disease the specific gravity of the blood serum has been known to sink from 1030 to 1018, the percentage of albumen from 8 to 4 per cent, corresponding to an increase in the amount of water from 90 to 95 per cent. One of the most common results of hydræmia is general œdema. This condition is mainly due to an impairment of the nutrition of the vascular walls by which they are rendered more permeable. Hydræmia favors serous transudation in two ways—*first*, by inducing nutritive changes in the vessel-walls, thereby increasing their permeability; *second*, by facilitating transudation from an increased fluidity when from any cause the walls of the vessels are impaired. In most forms of Bright's disease the walls of the vessels in the skin and in various parts of the body are impaired—partly as an element in the disease, partly as the result of hydræmia and altered composition of the blood.

Anhydræmia.—"A too concentrated state of the blood, in consequence of an absolute increase in its solid constituents, is not a recognized pathological condition. *Anhydræmia*, or a thickened condition of the blood from loss of water, is familiar to us in man only as a change resulting from excessive serous discharges from the intestines, particularly as a result of cholera. In cholera the blood may become so concentrated as to flow with difficulty and to present an almost tarry consistence. As there is an effort to repair the loss of water by absorption, the organs and tissues become shrunken and dry, the secretions are diminished or checked, the circulation is slow, the blood-pressure is reduced, and the pulse becomes feeble or imperceptible. The appearance of potash salts in the plasma indicates that red-blood corpuscles are destroyed. If reaction ensue after the choleraic discharges cease, the blood is rapidly restored to its normal percentage of water by the absorption of fluids taken into the system.

Hyperinosis.—"An abnormal increase in the amount of fibrin in the blood constitutes *hyperinosis*, and abnormal diminution of the fibrin is called *hypinosis*. The quantity of fibrin which coagulates from the blood is believed to depend less upon the amount of fibrin-forming substances in the blood than upon the presence or absence of conditions which favor or impede the coagulation. Thus, in acute infectious diseases, acute icterus, and other diseases in which hypinosis was supposed to exist, the imperfect coagulation of the fibrin is now attributed to decomposition of the blood and to the presence of agencies which interfere with coagulation. Human blood yields in health 0·1 to 0·4 per cent of dried fibrin. In hydræmia and in acute inflammatory diseases more fibrin is formed from a given quantity of blood than in health. This excess in hydræmia probably depends upon the greater amount of plasma. In acute rheumatism and in erysipelas more than one per cent of fibrin has been obtained from the blood. The so-called *buffy coat*, or

inflammatoria, is due to the slow coagulation of the fibrin, so that the red corpuscles have time to sink and leave the upper layers of the coagulum uncolored. This appearance of blood removed by venesection is not characteristic of inflammation, and has no diagnostic value.

Leucocytosis.—"According to the nomenclature proposed by Virchow, a temporary increase in the number of white corpuscles in the blood is called *leucocytosis*, while a permanent and usually much greater increase constitutes the disease called *leucocythæmia*. White corpuscles normally exist in the blood in the proportion of 1 white to 350–500 of red corpuscles. Leucocytosis is present in inflammations attended with profuse suppuration. It is also observed in fevers. A relative and sometimes absolute leucocytosis is often present in anæmic conditions. But the increase in white corpuscles in these conditions rarely approaches in degree to that found in the disease known as leucocythæmia, in which the proportion of white to red may be as 1 to 10, 1 to 3, and cases are reported in which the white exceeded the red. In leucocythæmia the number of red corpuscles is greatly diminished, and the symptoms are chiefly those of anæmia."

Alterations in the Gases of the Blood.

The gases contained in the blood are oxygen, carbonic acid, and nitrogen. The oxygen is for the most part in unstable combination with hæmoglobin, in the form of oxyhæmoglobin. There may be also a small amount of oxygen simply dissolved or absorbed in the plasma. The oxygen may be easily driven out of the blood by other gases, as carbonic oxide, or by a vacuum. Carbonic acid exists in the plasma and in the red corpuscles of the blood only in combination with alkalies or alkaline salts; none is held in simple solution. Nitrogen is simply absorbed. An *increase* in the quantity of oxygen in the blood sufficient to give rise to morbid symptoms is generally due to the *inhalation of compressed air*. "Death will occur when the proportion of oxygen in the arterial blood is augmented one third. In cases of superoxygenation of blood, the oxidation of the tissues is diminished, the production of carbonic acid, the excretion of urea, and the destruction of sugar in the blood is lessened, and, as a result, the temperature is lowered."

"*Deficiency* of oxygen in the blood is of much greater pathological importance than its increase. If the quantity of oxygen in the blood be greatly diminished, there follows a group of symptoms to which the names suffocation, asphyxia, and cyanosis are applied. After death from rapidly produced suffocation, the blood is of a dark color, and usually, though not always, fluid, or imperfectly coagulated; the right cavities of the heart are as a rule distended with blood, the mucous membrane of the larynx and trachea congested; ecchymoses are frequently present beneath the pleura and pericardium. In consequence of the fluid condition of the blood, there is hypostatic congestion of most organs, and livid spots on the most dependent parts of the surface of the body.

"After poisoning by carbonic oxide, the blood is bright red instead of dark, unless the gas has been partly or wholly converted into carbonic acid. The most prominent effects of suffocation from this cause are dyspnœa, convulsions when rapidly induced, lowering of temperature, elevation of the blood-pressure, dilatation of pupils, protrusion of eyeballs and a dark, so-called, cyanotic hue of the surface, unconsciousness, anæsthesia, and death. Increase and diminution in the oxygen, and increase in the carbonic acid, are the only alterations of the gases of the blood which require to be considered under the general pathology of the blood."

Changes in the Inorganic Salts of the Blood.

"Although the inorganic salts are present only in small amount in the blood (8 parts to 1000, of which about one half is chloride of sodium), they doubtedly have an important part in the vital processes. The effects of

their withdrawal from the food are described in works on physiology. There seems to be no diminution in the chlorides of the blood in pneumonia and in the fevers, notwithstanding sometimes an entire absence of chlorides in the urine in these affections. The diseases rachitis and osteo-malacia are supposed by many to depend upon an insufficient amount of the salts of lime in the blood. There appears to be a definite relation between the quantity of albumen and that of salts in the blood, diminution in the albumen being attended by increase in the salts."

CHANGES FROM ACCUMULATION OF ABNORMAL SUBSTANCES.

"*Glycohæmia* signifies the presence of sugar in the blood. A small amount of grape-sugar exists normally in the plasma of the blood. This normal amount is estimated at from 1 to 2½ parts per 1000. The quantity of sugar is about the same in venous and arterial blood. If the quantity of sugar exceeds 3 parts per 1000, it appears in the urine, constituting the condition called glycosuria. Milk sugar is present in the urine of females during lactation. This condition is *lactosuria*. Glycosuria may be a temporary condition in health and in disease, or it may be long-continued. Prolonged glycosuria is attended by a group of characteristic symptoms, and is called *diabetes mellitus*. The amount of sugar in the blood of diabetic patients may be 9 parts to 1000 of serum. In the milder cases of diabetes the sugar may be made to disappear from the urine by withholding saccharine and amylaceous articles of food. In other cases the sugar remains, although in diminished amount, during a diet of strictly animal food. Permanent glycosuria may appear as a symptom of certain affections of the central nervous system, particularly tumors and hæmorrhages involving the medulla oblongata, which probably cause vaso-motor paralysis of the blood-vessels of the liver, and to hasten thereby the circulation through the organ, increasing its glycogenic functions.

Acetonæmia.—" The presence of a substance called *acetone* in the blood in certain diseases has been supposed to be the cause of grave symptoms. This substance, which is a derivative of acetic acid, is recognized in the breath and in the urine by a peculiar odor resembling that of chloroform. Its presence has been demonstrated by chemical analysis in the urine of diabetic patients who emitted the characteristic odor. This odor indicates the presence of acetone also in certain cases of gastritis, cancer of the stomach, fevers, and alcoholic intoxication. Acetonæmia has been adduced as the cause of a form of coma which occurs in diabetes usually accompanied by severe dyspnœa, and often preceded by a period of excitement. The odor of acetone has been detected in the breath and the urine in certain cases of diabetic coma, but not in all.

Uræmia.—" By *uræmia* is understood the accumulation in the blood of excrementitious substances of the urine when the function of the kidneys is interrupted or much impaired. The most important effects produced are coma, epileptiform convulsions, preceded often by headache, vomiting, and diarrhœa. The convulsions usually precede the coma, but either may appear alone. Amaurosis, dyspnœa, and maniacal delirium are also to be included among the occasional manifestations of uræmia. Uræmia is usually the result of the acute or chronic form of Bright's disease. It may attend any disease in which the excretion of urine is more or less completely suspended, as stricture of the urethra, cystitis, etc. The effects of uræmia appear to be due to retention not only of urea, but of all the waste products, consisting mostly of nitrogenous substances in different stages of metamorphosis which are retained not only in the blood, but finally in the tissues. The nutritive processes are in this way disturbed, and especially the nutrition of the nervous system.

Ammoniæmia.—" An ammoniacal condition of the blood has been referred to the absorption of carbonate of ammonia formed in decomposed urine in cases of retention of urine, of cystitis from stricture of the urethra, enlarged prostate, paralysis of the bladder, pyelitis, etc. Some writers consider am-

moniæmia the cause of the symptoms often observed in the late stages of cystitis and pyelitis. These symptoms are irregular chills, fever, dryness of the mucous membranes exposed to the air, vomiting, diarrhœa, delirium, somnolence, and coma. Ammoniacal exhalation from the lungs and skin are sometimes evident. But it has been suggested that these symptoms are rather those of septic infection than of ammoniæmia.

Lithæmia.—"Uric acid exists in minute quantity in the blood in health. Its abnormal accumulation constitutes the condition known as lithæmia. An abnormal quantity of uric acid is present in the blood in gout. It may also exist in increased amount in chronic lead-poisoning, leucocythæmia, and some other conditions. The uric acid is probably present in the form of a neutral urate of soda. The acid urate of soda is much less soluble than the neutral salt. In gout there is a deposition in various situations of concretions of urates, accompanied often by inflammatory processes. The gouty concretions, or tophi, as they are called, consist of urate of soda, probably as an acid salt combined often with the urate of magnesia and of lime, and carbonate and phosphate of lime. These deposits are found in and about the joints, especially the small joints of the foot and hand, in the cartilage of the pinna of the ear, in the straight tubes of the kidneys, in tendon, in the skin, nerves, vessel-walls, in the membranes of the cord, and in the spongy substance of bone. The causes which have been assigned for an excess of uric acid in the blood are the insufficient excretion of the acid, its increased formation in the system, and diminished alkalinity of the blood or lymph whereby the neutral urates are converted into the less soluble acid urates. In the deposit of urate concretions the solvent power of the blood and other fluids of the body are diminished. The most important elements in the ætiology of this condition are heredity, the use of wines and malt liquors, and a diet rich in albuminous and fatty substances. The alkalinity of the blood is often diminished by the absorption of organic acids which are generated by digestive disturbances.

Cholæmia.—"The presence of the essential constituents of the bile in the blood constitutes the morbid condition called *cholæmia*. The elements referred to are mainly the biliary coloring matters—bilirubin and biliverdin, and the salts of the biliary acids—namely, glycocholate of soda and taurocholate of soda. If the coloring matter of the bile exist in the blood, it will appear in from forty to sixty hours in the urine and in the tissues, to which it gives a yellow color. This condition is called *icterus*, or *jaundice*. The biliary coloring matters and the biliary salts are formed in the liver, and do not pre-exist in the blood. But it is probable that, under pathological conditions, bilirubin may be formed in the blood from dissolved hæmoglobin. Certain poisons and infectious principles are believed to cause the destruction of some of the red blood corpuscles, and the appearance first of hæmoglobin, and afterward of biliary coloring matter in the urine. Icterus, as thus induced by changes in the blood itself, is called *hæmatogenous*, in distinction from the usual form which is designated as *hepatogenous*. Hepatogenous cholæmia is dependent upon the absorption of the biliary coloring matter, and the biliary salts after their formation in the liver. These materials appear to be absorbed by the lymphatics of the liver and conveyed by the thoracic duct to the blood. In exceptional cases of cholæmia, the bile appears to have an intensely noxious influence on the nervous system, causing convulsions, coma, and death. The hæmic condition to which these effects are referable has been called cholæmic intoxication. These cases of grave jaundice are thought to be due to the accumulation in the blood of cholesterin. This is an excrementitious principle of bile, derived chiefly from disassimilation of nervous tissue. A morbid increase of cholesterin in the blood is termed cholesteræmia. It is probable that a deficient elimination of cholesterin may occasion more or less of those indefinite ailments which are commonly embraced under the name of *biliousness*. Such ailments may occur without as well as with jaundice, and may be relieved by remedies supposed to increase the functional activity of the liver, and thus eliminate cholesterin, as well as other excrementitious principles of a toxical character.

Melanæmia.—"Melanæmia is that condition of the blood in which granular pigment is present. The pigment is black or brown in color, and in the form either of small roundish or angular granules, or of larger irregular flakes or masses. It exists partly free and partly inclosed in leucocytes. Melanæmia is observed in cases of malaria. It is met with chiefly in the pernicious forms of intermittent and remittent fever, and sometimes in chronic malarial cachexia. In melanæmia the red-blood corpuscles are diminished with or without an increase in the white corpuscles. The pigment appears to be the result of destruction of the red corpuscles. Melanæmia is developed during a malarial paroxysm, and may disappear in the course of two or three days after the attack, though it may continue for months. The pathological effects of the melanæmic condition can not be considered as established. It has been supposed that the accumulation of the pigment granules and cells in different organs may occasion obstruction to the circulation sufficient to interfere materially with the function of the organs. It is uncertain whether the cerebral phenomena—stupor, delirium, convulsions, or paralysis—observed in certain forms of pernicious fever, are to be referred to the accumulation of pigment in the brain or not.

Septicæmia.—"By the term septicæmia is meant a morbid condition of the blood due to putrid infection—to the infection with some poison contained in putrefying substances. The name *sepsin* has been proposed for this substance. There is no proof that the agent of infection in septicæmia is a living contagion, or animated germ. Septicæmia is observed most frequently after wounds, especially those complicated by injuries of bone, and by contusion or laceration of the soft parts. Its first symptoms appear usually in two to four days after the infliction of the wound, and before suppuration has been fairly established. The changes which render a wound a source of infection are believed to be those of decomposition. The discharge of the wound is then ichorous, the surrounding parts are œdematous, and sometimes gangrenous. Septicæmia may also be caused by gangrene, by ill-conditioned abscesses, and by inflammations in general. The hectic fever of phthisis, the suppurative fever of small-pox, and certain other secondary fevers, are considered by some as due to septicæmia. It is probable that the healthy respiratory and intestinal mucous membranes can absorb septic poison generated outside of the body.

"Septicæmia may be ushered in by a chill; but this is not constant, and repeated chills do not occur. There is, as a rule, a continuous, usually high fever, without distinct type. The skin is dry and hot, or at times there may be profuse perspiration. There is usually a yellowish hue of the skin, but the icterus is not intense. The pulse is small and frequent. The tongue and lips are dry. Diarrhœa is inconstant. The urine is scanty and high-colored. It may contain albumen. From the outset the patient is indifferent and apathetic. There may be low delirium. Death is preceded by stupor, and frequently by decline of temperature. The duration may vary from a day or two to several weeks. It is usually about a week. It is supposed that septic poisoning in a mild or moderate degree not infrequently occurs and ends in recovery; but in the cases in which the symptoms denote a grave affection, the proportion ending fatally is very large."

Pyæmia.—This morbid condition of the blood, like septicæmia, is of a traumatic, infectious nature. As the name denotes, pyæmia is supposed to be due to the entrance of pus into the blood. "A recognized distinction between pyæmia and septicæmia is, that, in the former, multiple abscesses are present, and in the latter they are absent. In pyæmia, venous thrombi are formed, from which infectious emboli are detached, causing abscesses; these emboli are wanting in septicæmia. Wounds and surgical operations, especially those involving bone, are the most common causes of pyæmia; but this condition does not occur until after suppuration is established. The discharge from the wound becomes thin and scanty, and there is œdema of the surrounding parts. The thrombi in the veins developed in pyæmia do not organize, but soften and give rise to infectious emboli. These emboli

cept when the thrombosis is in some of the rootlets of the portal vein) are carried first to the lungs, where they cause abscesses, which are frequently surrounded by hæmorrhagic infarction or lobular pneumonia." Abscesses may also be present in the spleen, kidney, heart, liver, muscles, and other parts of the body. Suppurative inflammation of the joints and of the serous membranes is usually present in pyæmia. There may be inflammation of the lymphatic vessels and the lymphatic glands near the primary source of infection.

The clinical history of pyæmia is characterized by repeatedly recurring chills, more or less pronounced, occurring irregularly and followed by profuse sweating. Fever is persistent, varying, as shown by the thermometer, in different cases, the greatest amount of heat being directly after the chill, the mercury rising at this time from 104° to 108° F. "The skin becomes sallow and not infrequently distinctly jaundiced. The intelligence is but little or not at all disturbed. There may be pain in the chest, with cough and frequent respiration, and physical exploration may show pleuritis with effusion or bronchial râles, with broncho-vesicular respiration at different points on either side of the chest, or on both sides. Pain may be felt in the knee and other joints, and effusion within the synovial membrane may be discovered. At length, persistent collections, not preceded by the usual local symptoms of phlegmonous inflammation, 'cold abscesses,' as they are sometimes called, may be found in different situations—sometimes in one or more of the limbs, and sometimes on the trunk. The formation of purulent matter in these situations is sometimes extremely large. Suppurative inflammation of the eye leading to sloughing, and the evacuation of the humors, is an occasional event. This has been observed chiefly in cases of pyæmia following parturition. The affection in most cases runs a rapid course, the duration being from eight to ten days. With less intensity the disease may continue from two to four weeks, and occasionally it becomes chronic, lasting for several months. In the latter cases the duration depends on the secondary abscesses, which, by their continuance, become properly the sequelæ of the pyæmia. In the vast majority of cases the affection ends fatally." Death, in some cases, appears to be due to the asthenia incident to the morbid condition of the blood, and sometimes to the secondary affections of the viscera. In the cases which recover, the local effects consist chiefly of subcutaneous purulent collections and arthritic suppuration.

Anatomical Changes in the Solid Parts of the Body.

The physiological relations of the blood to the solid parts are so intimate and important as to render it intelligible that morbid alterations in its composition lead, secondarily, to changes in the solids, as well as that diseases of the solids affect the composition of the blood. Many of the anatomical changes of solid parts are due to abnormal conditions of the circulation.

Local Disturbances of the Circulation.

The morbid conditions embraced under this heading relate to local anæmia, hyperæmia, hæmorrhage, thrombosis, embolism, transudation, and inflammatory exudations.

Local Anæmia.—Local anæmia signifies a deficiency of blood in a part. The condition is due either to an increase of the resistance naturally offered to the flow of blood through a part, or to the presence of new obstacles within or outside of the vessel. "Increase of the natural resistance is caused by contraction of the arteries, in consequence of either direct stimulation of their muscular coat, or under vaso-motor influence. The pallor of the skin from the effects of cold, and that of the face at the onset of an epileptic paroxysm, or in consequence of violent emotions, are examples of local anæmia, in consequence of spasms of the arteries. Atheroma, obliterating endarteritis, thrombosis, and embolism may be cited as causes of local anæmia acting within

the vessels. Compression of the arteries by tumors, exudations, and bandages, illustrate the effects of external agents. In case of thrombosis and embolism, the presence or absence of arterial anastomosis is of great importance in determining the degree of anæmia which follows the obstruction of an artery. By collateral anæmia is understood the diminution of the amount of blood in a part in consequence of its excessive accumulation in other parts." An anæmic part is generally pale, shrunken, dry, and, if exposed to the air, of lowered temperature. The effects of long-continued and marked anæmia of a part are atrophy and frequently fatty degeneration. If the anæmia be extreme, coagulation-necrosis may result.

Hyperæmia.—An increase of blood in the vessels of a part constitutes *hyperæmia.* Two forms of hyperæmia are recognized—*active* or *arterial*, and *passive* or *venous.* Active hyperæmia is sometimes called fluxion, or congestion. In this condition an increased amount of blood is brought to a part by the arteries. A gland, or other organ, is in a state of *functional hyperæmia* during its physiological activity. "The usual cause of active hyperæmia is in reality a passive relaxation of the muscular coats of the arteries of a part, so that there results a diminution of the resistance naturally offered by the arterial tension to the circulation of the blood. This relaxation may be the result of a direct paralysis of the muscular coat, but is usually referable to paralysis of the vaso-motor nerves." There is some reason to believe in the existence of vaso-dilator nerves, the irritation of which causes dilatation of the arteries and consequent hyperæmia.

Collateral or *compensatory hyperæmia* is the transmission of an increased amount of blood to a part in consequence of the local anæmia of another, usually an adjacent, part. The sudden removal of long-continued pressure upon the arteries may be a cause of active hyperæmia—as, for instance, the over-distention of the abdominal walls following rapid withdrawal of large accumulations of fluid in the peritoneal cavity. In active hyperæmia the velocity of the blood-current is usually increased. The affected part is bright red in color, swollen, and, if superficial, warmer than normal. Active hyperæmia is usually an acute, transitory condition.

Passive hyperæmia is due to some obstruction to the flow of blood in the veins. From the nature of the obstruction, it is also called mechanical hyperæmia, and venous hyperæmia, inasmuch as it is venous blood which accumulates in the parts. Passive hyperæmia is frequently a chronic condition. The abnormal hindrances may be either within or without the veins. Thrombi are the most frequent obstacles within the veins. General venous hyperæmia follows obstruction to the flow of blood through the heart. The veins may be compressed from without by clothing, bandages, tumors, exudations, newly formed fibrous tissue, etc.

By *hypostasis*, or *hypostatic congestion*, is understood venous hyperæmia of dependent parts of the body under the influence of gravity and of enfeebled heart's action. "In most parts of the body the anastomoses between the veins are so many that a single vein, or even several, may be obstructed without serious disturbance of the circulation. Occlusion of the portal vein can not be compensated for thus by collateral circulation. Venous hyperæmia of the lower extremity also follows thrombosis of the femoral vein. In passive hyperæmia the blood is dammed back upon the veins and capillaries of the part, the velocity of the circulation is lessened, the vessels become over-distended with blood, frequently a transudation of serum and a diapedesis of red-blood corpuscles ensue, and an increased amount of lymph flows from the obstructed region. The affected part is usually bluish-red in color, swollen, frequently œdematous, and, if exposed to the air, cooler than normal. The diagnosis of hyperæmia can not always be made upon post-mortem examination, as the distribution of blood may vary greatly from that present during life." This is particularly true of active hyperæmia.

Hæmorrhage.—"Hæmorrhage is the escape of blood through the walls of the vessels or of the heart. When the extravasation is through the ruptured wall of a vessel, it is called hæmorrhage by *rhexis;* when the red-blood cor-

puscles are pressed through the unruptured vascular wall, it is denominated hæmorrhage by *diapedesis*, or simply diapedesis; when the hæmorrhages are minute, they are called *ecchymoses;* when the blood infiltrates the tissues uniformly without tearing them, the extravasation is a *hæmorrhagic infarction;* when the escaped blood forms a tumor, it is called a *hæmatoma*. According to the source of the blood, hæmorrhages are classified as cardiac, arterial, capillary, and venous. Rupture of healthy vascular walls is usually due to traumatism, or to local elevation of the blood-pressure. Among the conditions which weaken the walls of the vessels and favor their rupture, the most important are aneurism, atheroma, ulcerative processes acting from without, infiltration of the vascular walls by new growths or inflammatory products, and perhaps fatty degeneration. It is doubtful if elevation of the general blood-pressure ever causes rupture of healthy vessels, but it may contribute to the giving way of those which are diseased.

"Diapedesis occurs in venous hyperæmia, in inflammation, and in hæmorrhagic infarctions. It is due in venous hyperæmia to the increased intra-vascular tension, and in inflammation, as also, probably, in hæmorrhagic infarctions, to changes in the vascular walls, which are thereby rendered more permeable. The red-blood corpuscles pass through the walls of the veins, and especially of the capillaries, making their way between the endothelial cells, whether through pre-formed stomata or not is uncertain. Diapedesis is a passive process as far as the red-blood corpuscles are concerned. Hæmorrhages by diapedesis are generally small, but sometimes visible to the naked eye, and exceptionally they are considerable. It is not always possible to determine whether an extravasation is the result of rhexis or of diapedesis. A number of diseases are accompanied by a hæmorrhagic tendency, such as purpura, scurvy, tuberculosis, phosphorus poisoning, and numerous infectious diseases, as septicæmia, yellow fever, small-pox, and ulcerative endocarditis. The hæmorrhage in these cases is, no doubt, partly due to a weakened condition or malnutrition of the vessel-walls, in consequence of the disordered composition of the blood; but whether the blood escapes by rhexis or by diapedesis has not been established in the majority of instances. The changes which take place in a hæmorrhagic extravasation lead to the gradual absorption of most of its constituents. The fluid parts are absorbed, the fibrin becomes granular and is taken up, the white-blood corpuscles in part wander into the tissues and absorbents, but in greater part disintegrate and are absorbed. Some of the red-blood corpuscles are carried away by the lymphatics; others remain and undergo pigmentary transformations. The formation of pigment takes place in great part in wandering cells which take up fragments of corpuscles. The resulting granular and crystalline hæmatoidin pigment may remain in the cells or be set free. Thus, only pigment may remain to tell of the seat of former extravasation, and even this pigment may in time be absorbed. These changes may be complicated by acute and chronic inflammatory processes, including the formation of so-called apoplectiform cysts in the brain in case of cerebral hæmorrhage.

Thrombosis.—"A coagulum formed during life in the heart, or in the vessels, is called a *thrombus*. A thrombus is designated as *parietal* when it is attached to the wall of a blood-vessel which it only partially obstructs. An *occluding* thrombus completely fills the interior of a vessel. The causes of thrombosis are, *first*, changes in the walls of the vessels; and, *second*, retardation of the circulation. Of the alterations in the vascular walls which cause thrombosis, the most important affect the endothelial lining, the integrity of which is believed to be an essential condition of the fluidity of the blood, and the greater number produce irregularities upon the inner surface of the vessel. The leading structural changes are incident to acute and chronic inflammations (embracing atheroma and endocarditis), calcification, degeneration of the endothelium, and new growths. *Compression thrombosis*, which results from narrowing of the vessel by external pressure, and *traumatic thrombi*, which form in wounds of vessels, also belong to this group of

causes. The *dilatation thrombi* and the *marantic thrombi* are the most important of those caused by retardation of the circulation. The former are produced in consequence of abnormal dilatation of the vascular channels, as in aneurisms and in varices. Marantic thrombi are the result of great weakening of the circulation, such as comes from extreme debility and from much enfeebled heart's action. The veins of the lower extremities and of the pelvis, and, in children, the cerebral sinuses are the favorite seats of marantic thrombi. In many instances—as, for example, in thrombosis following ligature of a vessel—structural alterations and slow circulation combine as causes of thrombosis. Primary venous thrombi form especially in the pockets of the valves, cardiac thrombi in the right auricular appendix and in the apex of the right ventricle. A thrombus extends at least from the point of its formation to the nearest branch given off from the vessel; it may extend farther forward and backward, and may grow into the lateral branches.

"Thrombi vary in structure according to their formation from the blood while in motion or at rest. *White*, *red*, and *mixed* thrombi are thus distinguished. Red thrombi are formed from blood at rest, as, for instance, in a vessel inclosed between two ligatures, and are composed of red and white corpuscles and fibrin, the coagulum being similar to that of blood withdrawn from the body. White thrombi are really grayish or reddish gray in color, and are composed chiefly of white corpuscles and fibrin. They are formed from the circulating blood, and are produced by an accumulation of white-blood corpuscles. The white corpuscles subsequently loose their nuclei, seem to coalesce with each other, and produce a granular material with the properties of fibrin. Mixed thrombi constitute a variety of the white. They are composed usually of layers—some white and some red. The great majority of all thrombi are white or mixed. A thrombus is more or less firmly adherent to the wall of the vessel. Yellowish white, so-called decolorized post-mortem clots, are frequently mistaken for ante-mortem thrombi. Those so often found in the right cavities of the heart, with prolongations extending into the branches of the pulmonary artery, have been erroneously assigned as the cause of death. These light-colored clots are produced when the coagulum forms so slowly that the corpuscular elements, particularly the heavy red-blood corpuscles, have time to sink to the bottom, so that the upper portion of the coagulum consists almost wholly of fibrin, with some white corpuscles. The light post-mortem clots, therefore, consist of a lower red mass and an upper whitish, fibrinous material; they are not intimately adherent to the vascular wall; they have a gelatinous, translucent appearance, and are not distinctly stratified. The *ante-mortem thrombi* may consist of red and gray layers, but these are irregularly arranged; they are opaque, granular in appearance, distinctly stratified, and adherent to the wall of the vessel.

"A thrombus may remain a long time without much change, or it may undergo metamorphosis in one of two directions—either *organization* or *softening*. The so-called organization of a thrombus results in the formation of vascularized connective tissue in the place of the thrombus. Instead of organizing, a thrombus may break down in its central portion into a grayish red pulp, consisting of granular material with some blood corpuscles and some blood pigment. In this way some thrombi, especially globular thrombi in the heart, may resemble cysts with fluid contents. A different and more serious form of softening is that which occurs in thrombi containing some infectious principle. Portions of this softened material entering the circulation form a fruitful source of general infection. These infectious thrombi form in diseases characterized by blood-poisoning, such as pyæmia, acute ulcerative endocarditis, puerperal fever, etc. Sometimes the thrombi in varices become impregnated with the salts of lime and form concretions called phleboliths.

"The effects and symptoms of thrombosis, in the first place, depend upon the *mechanical obstruction* to the circulation. The degree of this obstruction depends upon the situation and extent of the thrombus. A parietal thromb

may produce so little obstruction as to give rise to no symptoms. Completely occluding thrombi produce no mechanical obstruction when lodged in vessels provided with anastomoses which afford sufficient collateral circulation. Thus a thrombus in one of the venæ-comites of an artery forms no apparent hindrance to the circulation. On the other hand, thrombosis of the portal vein (pylo-thrombosis) or of the femoral vein (phlegmasia alba dolens) is followed by well-marked symptoms of venous obstruction, such as passive hyperæmia, with more or less transudation of serum and diapedesis.

"The mechanical effects of arterial thrombi are anæmia of the part supplied by the artery, and necrosis, or hæmorrhagic infarction. These effects are usually absent when the thrombus is seated in an artery the branches of which communicate freely by anastomosis. The slow development of thrombi favors the development of collateral circulation. Infectious thrombi cause suppuration, and sometimes necrosis in the vascular walls, as well as the tissues where they are lodged."

Embolism.—A special danger attendant upon thrombosis is the detachment of portions of thrombi and their transportation by the circulation into smaller vessels which they obstruct. These severed fragments of thrombi, or even entire thrombi, which enter the circulation are called *emboli*. An embolus is a plug of some material which is transported by the blood-current from one situation to another. "An embolus may consist of any substance which makes its way into the current of blood. The majority of emboli are fibrinous, being derived from thrombi. But emboli may consist also of portions of a tumor growing within a vessel, of fragments of diseased cardiac valves, of animal and vegetable parasites, of concretions of lime, of pigment, of fat, or of bubbles of air. It is evident that a migratory plug or an embolus can hardly be arrested in its course through veins (with the exception of the venæ portæ), since the course of the blood-current is from smaller to larger vessels. Embolism, therefore, relates to the arteries, with the single exception of the *venæ portæ*, while a thrombus may be formed anywhere in the vascular tract."

A parietal thrombus may be washed off partially or completely by the blood-current. The thrombi of the so-called vegetations formed on the cardiac valves in endocarditis are a fruitful source of emboli. An end of a thrombus may be broken off by the force of the current from a vessel over the mouth of which the thrombus projects. Finally, fragments may be detached from thrombi in consequence of softening. "Emboli consisting of oil-globules enter the circulation most frequently after fracture of the bones, particularly when accompanied by extensive laceration of the marrow. Fat set free from marrow-cells enters the open mouths of ruptured veins. The oil-drops collect chiefly in the pulmonary capillaries, where they can be recognized only by the microscope. They may pass through these capillaries and lodge in the glomeruli of the kidneys, in the cerebral capillaries, and in other capillaries of the body. Fatty emboli are generally innocuous." The sudden entrance of a large quantity of air into the blood-current, such as may occur from incision of the large veins near the heart, or its forcible introduction by the hypodermic syringe or the reversed action of an aspirator, is a cause of rapid death. The fatal termination is due to the accumulation of air in the right cavities of the heart, the contractions being insufficient to force the elastic air forward. The air remaining in the right auricle and ventricle prevents the entrance of blood from the venæ cavæ and arrests the pulmonary and systemic circulation. "Of especial interest and importance is the study of the mechanical effects of emboli. In certain organs and parts of the body the branches do not anastomose with each other, communications existing only between the capillaries and between the veins. Such arteries are the renal, splenic, pulmonary, some of the cerebral, and the central artery of the retina. The branches of the venæ portæ also do not enter into anastomoses with each other. When an embolus lodges in an artery supplied with abundant anastomoses, for instance, a muscular artery, or one of the arteries of the extremities, collateral circulation is established which prevents the part suffering i

nutrition or function, and so its effects are comparatively harmless. But the effect is widely different if no anastomoses exist between the peripheral part of the occluded artery and other vessels. In such cases no arterial blood, or an insufficient amount, is sent to the capillaries of the part supplied by the artery. The part suffers in nutrition, and may even undergo necrosis and death. An extravasation of blood sometimes takes place in the vicinity of the obstruction. These alterations constitute *embolic infarctions.* The seats of embolic infarction are the kidneys, spleen, brain, lungs, retina, and, under certain circumstances, the liver and small intestines; very rarely other parts of the body. In certain parts of the brain, simple anæmic softening, with or without hæmorrhage, follows embolism. Embolism of a branch of the pulmonary artery is often without effect; at other times, especially in the periphery of the lung, a hæmorrhagic infarction results."

Cohnheim explains the source of the extravasated blood in embolic hæmorrhagic infarction as due to a backward flow of venous blood into the empty arterial branches beyond the seat of the emboli. The capillaries of the obstructed district become filled with blood which has regurgitated from the veins. The walls of these arterial and venous capillaries, not receiving fresh arterial blood, become weakened from lack of nutrition, and allow a diapedesis of the red-blood corpuscles. These embolic infarctions are wedge-shaped, the base being toward the periphery, thus corresponding to the area of distribution of the obstructed artery. A reactive inflammation, resulting in the formation of new connective tissue, gradually takes the place of the infarction, many of the constituents of the latter being absorbed. The infarctions lose their dark-red color and become yellowish. The termination is in a cicatrix of fibrous tissue.

"The presence of disease of the arteries and an enfeebled circulation may be important factors in determining the effects of an embolus. Thus embolism of the femoral artery produces no permanent injury when the force of the circulation is normal and the anastomosing arteries healthy; but it may be followed by gangrene of the lower extremity if the heart's action be feeble and the arteries atheromatous. Embolism of the main trunk of the pulmonary artery, or of certain arteries of the medulla oblongata, causes sudden death. In certain situations and under certain circumstances, the local anæmia caused by an embolus is of brief duration. Thus, a temporary loss of function disappears when the vessels beyond the seat of obstruction are filled by collateral arterial branches. Infectious emboli produce effects entirely distinct from the mechanical obstruction to the circulation. Those arising from infecting thrombi incite suppurative inflammation, and perhaps necrosis, wherever they lodge. Thus, even capillary emboli, when infectious, produce abscesses." The multiple abscesses in pyæmia are for the most part of embolic origin.

Transudation.—"Transudation is the filtration of a fluid resembling the serum of the blood through the capillary walls. A distinction is made between *transudation* and *exudation*. An exudation is inflammatory in its origin, a transudation is non-inflammatory; and exudation is usually richer in albumen and white-blood corpuscles than a transudation, and is distinguished especially by the presence of coagulated fibrin. But both transudations and exudations vary greatly in their composition, and it is impossible to draw a sharp line of distinction between them. In fact, the two terms are often used synonymously.

"Transudation may take place in different situations. Occurring in situations from which the liquid can not escape—namely, within serous cavities and into the tissues—they constitute *dropsies;* occurring upon mucous surfaces, they form one variety of *fluxes.* Dropsies receive different names according to their situation. In serous cavities they are designated by prefixing *hydro* to the name of the membrane affected. Hydrocele is a serous accumulation in the tunica vaginalis. Serous transudation into the tissues, particularly into the interstices of connective tissue, is called *œdema.* When subcutaneous œdema extends over the greater part of the body, it receives

name *anasarca*. Serous effusion into the pulmonary air-cells is called *œdema of the lungs*, contrary to the usual signification of œdema. The term *hydrops* signifies a serous effusion, usually in a cavity. Dropsical effusions are generally clear, colorless, or slightly yellow, and alkaline in reaction. They may be stained by an admixture of blood or of biliary coloring matter. They contain the same salts as the serum of the blood, and in about the same proportion. The amount of albumen being slightly less than that present in the blood plasma, transudations into pleural and peritoneal sacs are richer in albumen than those in the subcutaneous tissue, while the transudations in the subarachnoid space contain the least proportion. Transudations in the living body very rarely contain fibrin. In very rare instances, transudations in the pleural and the peritoneal cavities have been rendered milky in appearance by an admixture of chyle derived from the chyle-vessels, particularly of the thoracic duct, in consequence of their occlusion or rupture. Such a transudation is called *hydrops chylosis*. Examined microscopically, transudations are found to contain a few leucocytes and some red-blood corpuscles —the latter occasionally in abundance.

"The most efficient causes of dropsy are, *first*, hindrances to the outflow of blood through the veins, causing venous hyperæmia; *second*, alterations in the walls of the blood-vessels, especially those induced by hydræmia. Dropsies due to the first of these causes are called *mechanical;* those due to hydræmia are called *cachectic* or *hydræmic*. Diseases of the heart or of the lungs which impede the return flow of the blood from the venæ cavæ produce general dropsy when the hindrance is sufficiently great. General dropsy is characterized by anasarca and transudation into the serous sacs. The most frequent and important of the mechanical causes of general dropsy is cardiac disease. The mechanical causes of local dropsies are those of venous hyperæmia, which have been already mentioned. The most important of the local dropsies is hydro-peritonæum, or ascites dependent upon obstruction of the venæ portæ. Thrombosis of the portal vein (pylo-thrombosis) and certain hepatic diseases, especially cirrhosis, cause portal obstruction. With ascites, general dropsy, due to a morbid condition of the blood in the majority of cases, is connected with those affections of the kidney embraced under the name of Bright's disease. The hydræmia which results from the excretion of albumen by the urine in this disease is not the immediate cause of the dropsy, but it induces in the vascular walls changes which render them more permeable. Other cachexia, especially the cancerous and the tuberculous, may be attended by hydræmic dropsy, although this is usually in less degree than that of Bright's disease. Some effusions which have been regarded as dropsical are really inflammatory in their origin—that is, due to an inflammatory alteration in the coats of the vessels. This is usually true of the so-called collateral œdema—that is, the œdema in the neighborhood of inflammatory infiltrations, tumors, etc. It is also true of œdema glottidis, and many cases of hydrocele and hydrocephalus."

Inflammatory Exudations.—According to the classical definition of inflammation, a part is acutely inflamed when it is hot, red, swollen, and painful. But this enumeration of symptoms (calor, rubor, tumor, dolor) gives no information as to the pathological nature of the process. No topic in medicine has been the subject of so much research and speculation as the nature of the inflammatory process, and even at the present time it is impossible to give a complete and correct definition of inflammation from a pathological or an ætiological standpoint. But the ancient theory, that the essential phenomena in inflammation are referable to the blood and to the blood-vessels, appears to be almost confirmed by modern investigators. A new era was introduced in the history of inflammation by Cohnheim's discovery in 1867 of the emigration of white-blood corpuscles from the vessels, and by his studies of the inflammatory process on living frogs. The first effect of the application of an inflammatory irritant is dilatation of the arteries, then of the veins, and last of all the capillaries. At the same time the velocity of the blood is increased. After a [illegible]iable time the blood begins to flow less rapidly, although the caliber of

the vessels remains unchanged. In some of the capillaries the circulation may come to complete stagnation or stasis, but this is not essential, nor usual, except where the action of the irritant is intense. As the rapidity of the blood-current lessens, the white-blood corpuscles accumulate along the inner surface of the veins, where they remain nearly stationary. The remarkable phenomenon of emigration now takes place. A portion of a white-blood corpuscle soon appears upon the outer surface of a vein or a capillary, as a bud-like process connected by a delicate thread of protoplasm, with the remnant of the corpuscle inside. As the outer portion of the cell increases in size, the inner diminishes, until finally the entire corpuscle lies free outside of the vessel. The corpuscle passes through the cement substance between the endothelial cells lining the vessel. The evidence is not conclusive that it passes through pre-formed stomata or pores. Nor is it certain whether the corpuscles make their way through the vascular walls by their active amœboid movements, as the name emigration would imply, or whether they are pressed through by a passive process of filtration. Outside of the vessels they assume amœboid movements and change their shape and place. While the inner surface of the veins becomes plastered, as it were, with stationary white-blood corpuscles, the current of red-blood corpuscles continues unabated in the central part. White-blood corpuscles migrate from the veins and capillaries, but not from the arteries. Red-blood corpuscles also pass through the capillary walls by the passive process of diapedesis. Their number is not usually great, but, exceptionally, may be so considerable as to give a hæmorrhagic character to the exudation. Coincidently with the processes of emigration and of diapedesis, the fluid constituents of the blood filter through the walls of the vessels. This fluid exudation resembles in its composition the plasma of the blood, but it contains less albumen. It contains the elements of fibrin, and in most places finds the conditions requisite for the spontaneous coagulation of this substance.

A fibrinous effusion is, in the vast majority of cases, an inflammatory exudation. In simple inflammations of mucous membranes and in suppurative inflammations (abscesses) no fibrin is formed. Cohnheim explains these various phenomena of inflammation upon the assumption that the effects of the inflammatory irritant is to produce a molecular alteration in the walls of the vessels, which increases their permeability to the fluid and corpuscular elements of the blood, and increases the friction between the blood and the vessel-wall. It is maintained by Cohnheim that the sole origin of pus-cells is to be found in the emigration of the white-blood corpuscles, and that the fixed cells outside of vessels in inflammation do not produce pus-cells. These cells either remain unchanged, or degenerate, or proliferate and produce other cells of their kind (regenerative process), but never give rise to pus-cells, as it has been believed and taught by Virchow and Stricker. The accuracy of Cohnheim's microscopical observations of the process of inflammation in frogs has been established, and their applicability to the same process in man is now generally recognized. The dominating elements in acute inflammation are thus shown to be the emigration of white-blood corpuscles and the exudation of the fluid constituents of the blood in consequence of as yet undefined changes in the vascular walls.

As is evident from the foregoing description, the *products* of inflammation are fibrin, serum, pus-cells, and red-blood corpuscles. "In inflammation of mucous membranes an increased secretion of mucus may take place. Exudations are classified as *fibrinous*, *serous*, *purulent*, *hæmorrhagic*, and *mucous*, according to the relative proportion of the inflammatory products which they contain. *Fibrinous* exudation is best illustrated by the acute inflammations of serous membranes, where the fibrin is deposited as a layer upon the serous surfaces. These fibrinous layers can be readily stripped off, and are sometimes called *false membranes* and *coagulable lymph*. More or less white and red corpuscles are present in the meshes of the fibrin, and in the interior of the serous sac is a variable amount of fluid, containing, also, fibrin ar-
exuded cell-elements. Fibrinous exudation may be present, also, in infl

mation of the solid tissues in the air-cells of the lung, and upon mucous membranes. Fibrinous exudation upon mucous surfaces is called croupous, or diphtheritic, according to its nature. *Serous* exudations bear considerable resemblance to transudations, but they are generally richer in albumen and cells. The main distinction, however, is that they appear with the signs of inflammation. The exudation in so-called collateral œdema (which is really inflammatory) is generally serous; likewise the exudation in the early stages of many inflammations of mucous membranes. Inflammatory affections of the skin are accompanied often by the formation of vesicles containing serous exudation. Although pus-cells are present in all inflammatory exudations, it is only when they are sufficiently numerous to render it opaque that the exudation is said to be *purulent*. Pus consists of a fluid part (liquor puris) and of cells. Pus-cells are round, membraneless, and contain usually two or three nuclei inclosed in a cell-body of protoplasm, in which, as a rule, molecules of fat are present. Pus-cells belong to the widely distributed group of cells known variously as leucocytes, lymphoid cells, wandering cells, embryonic cells, small-round, indifferent cells. Their origin from emigrated white-blood corpuscles has been described. It is believed that pus-cells increase in number by division." As a rule, all pus is contagious: under certain conditions its presence invites those inflammatory processes favorable to its development. Inflammations producing pus are suppurative. The pus may be exuded from free surfaces, it may infiltrate the tissues (purulent infiltration), or it may be contained in cavities produced by the breaking down of tissue. Such cavities containing pus are called *abscesses*. When the exuded red-blood corpuscles are sufficiently abundant to give a red color to the exudation, the inflammation is said to be *hæmorrhagic*. According to Cohnheim, hæmorrhagic inflammations are referable to an intense action of the inflammatory irritant upon the vascular walls. Tuberculous, cancerous, variolous, and scorbutic inflammations of serous membranes are apt to be hæmorrhagic. The source of the hæmorrhage may be from rupture of the vessels, or from diapedesis.

As has been mentioned, the terms *croupous* and *diphtheritic* are applied to fibrinous exudations upon mucous membranes. "Unlike the inflammations of serous membranes, the ordinary inflammations of mucous membranes are not accompanied by a fibrinous exudation. The term *catarrhal* is sometimes applied to those simple inflammations of mucous membranes characterized by an exudation of serous mucus and some pus-cells. Fibrin is present in the inflammations of mucous membranes only when the epithelial covering is partly or wholly destroyed. The epithelium may be destroyed from various causes, the most important of which is coagulation-necrosis. The necrosis may extend deeper than the epithelium into the subjacent tissues. When only the epithelium is destroyed, the fibrinous exudation lies upon the membrana propria of the mucous membrane, from which it can be readily stripped off without loss of substance. This form of exudation is called *croupous*. When the primary necrosis involves the tissue-cells as well as the epithelium, the fibrinous exudation extends from the surface into the tissue of the mucous membrane, and can not be removed without loss of substance. This second form of exudation is denominated *diphtheritic*. When the fibrinous exudation adheres closely to the mucous membrane without really infiltrating it, it is called *pseudo-diphtheritic*." It is to be observed that croupous and diphtheritic exudations require destruction of epithelium only in one place, and that they may extend thence over the surface of the surrounding intact epithelium.

"The termination of inflammation may be various. A complete restoration of an inflamed part to its normal condition is called *resolution*. This, as a rule, only occurs in the milder grades of inflammation. The fluid part of the exudation can be readily absorbed; emigrated white-blood corpuscles may re-enter the blood-vessels, or may wander into the lymphatics, or they, as well as red-blood corpuscles and fibrin, may undergo fatty degeneration, and then be absorbed. The formation of new connective tissue, or the

organization of the exudation, as it is called, is a frequent termination of some forms of inflammation, particularly of the fibrinous exudations upon serous membranes. Such organizing exudations are sometimes termed *plastic*, or *adhesive*. In such cases the fibrin is absorbed, taking no active part in the development of new tissue. The new connective-tissue cells may spring from emigrated white-blood corpuscles, or from the pre-existing connective-tissue cells (including endothelial cells). The new tissue is at first very rich in capillaries and in cells (the former being derived, probably, from the old capillaries). Subsequently it becomes more fibrous, less vascular, and it contracts. Considerable accumulations of pus can not be absorbed, but, when not evacuated, either remain without changing their consistency, or become inspissated. Such dried masses of pus may undergo cheesy and calcareous transformations, and, becoming encapsulated, remain innocuous.

"Chronic inflammations may be secondary to the acute, or subacute from their origin. In the latter case they may be unattended by any free exudation. Chronic inflammation most frequently results in the formation of new connective tissue."

ACTIVE ALTERATIONS OF THE TISSUES.

The active alterations of the tissues constitute the third division of the general pathological changes next to be considered. These active alterations embrace pathological new formations, which will be grouped under the headings *regeneration*, *hypertrophy*, and *tumors*.

"The pathological new formations are the result of increased activity of cells, which are incited to abnormal growth and proliferation. It is to be borne in mind that the modern conception of a cell is based, not upon its etymological significance, but upon the presence in it of living matter, or protoplasm (also called bioplasm). Even formless clumps of protoplasm are sometimes called cells. Cells in the animal body are generally, if not always, provided with nuclei, and are usually devoid of enveloping membranes. Cells multiply by division. The multiplication of cells by endogenous growth and by budding has not been established. As the process is usually described, the first step in the proliferation of a cell is the division of its nucleus, and this is followed by division of its body, or protoplasm, each segment surrounding one of the nuclei. The doctrine of the so-called specialization of cells bears upon pathological new growths. Embryological researches have shown that, after the formation of the third blastodermic layers, the cells in each produce only certain kinds of cells and tissues; that, for instance, connective tissue and muscle can spring only from the middle blastodermic layer, and epithelium only from the external and internal blastodermic layers (part of the genito-urinary epithelium possibly excepted). It is now believed that, under pathological conditions, definite cells can be reproduced only by their kind—that, for example, new epithelial cells are always the offspring of pre-existing epithelium, and can not be developed out of connective-tissue cells or white-blood corpuscles. This view is best established for epithelial and nervous tissue. Connective-tissue cells, however, can be produced, apparently, by emigrated white-blood corpuscles as well as by pre-existing connective-tissue cells."

Regeneration.—The subject of the regeneration of tissues after their destruction by wounds and pathological processes is here considered only in outline. Some structures are reproduced with great ease—for example, connective tissue and epithelium; others with more difficulty, as muscular tissue and peripheral nerve-fibers; and, finally, others not at all, such as the central nervous system and the parenchyma of most organs.

"*Fibrillated connective tissue* is present in nearly all pathological formations. It may be produced slowly out of the pre-existing connective tissue, or it may be formed out of germinal or granulation tissue, as it is called. This granulation tissue is composed chiefly of round and spindle-shaped cells, with scanty and ill-defined inter-cellular substance, with blood-vessels with-

out compact walls. The granulation cells may be derived from emigrated white-blood corpuscles, or from proliferated connective-tissue cells. The round cells become spindle-shaped, and finally assume the various forms characteristic of connective-tissue cells; the inter-cellular substance increases in amount, probably at the expense of the cells, and becomes distinctly fibrillated, and the round and fusiform cells, when they constitute the embryonic walls of the capillaries, change into flat endothelial cells. The fully formed fibrous tissue is not so rich as the granulation tissue in cells and blood-vessels, some of which are therefore destroyed in the process of development. The newly formed blood-vessels may be as described—channels simply hollowed out between the granulation cells, which then constitute their walls. The more usual method of their formation, however, seems to be protoplasmatic offshoots from pre-existing capillaries. Conical prolongations of protoplasm project from the capillary walls at certain points, and unite with similar offshoots from other points. These prolongations are at first solid, but subsequently become hollowed out in their center, the cavity thus formed communicating with the lumen of the capillary vessels and receiving blood from them. At the same time, nuclei develop, and the protoplasm divides around the nuclei into cells, which now represent the endothelium of the newly formed capillaries. By additions to their coats of connective tissue and of smooth muscular fibers, and by widening of these lumina, these capillaries may change into arteries and veins. Among the circumstances under which connective tissue and blood-vessels are formed in the manner described may be mentioned the repair of wounds, the healing of ulcers, and the development of adhesions after inflammation of serous membranes. The regenerative changes frequently proceed side by side with inflammatory alterations, from which they can not usually be clearly separated.

"*Epithelium* is endowed with an especially active power of regeneration. It has been experimentally demonstrated that incised wounds of the cornea may be completely filled by newly developed epithelial cells within twenty-four hours. Nearly all recent observations go to prove that the new epithelium is always the offspring of the pre-existing epithelial cells.

"Regeneration of *striated muscular fibers* occurs after their degeneration in fevers, particularly typhoid fever, and in some other diseases, and sometimes after their destruction by wounds, especially subcutaneous wounds. Defects in muscular tissue by wounds, however, are more frequently filled by cicatricial connective tissue. But whether the new muscular tissue is produced only from the old, or is produced from cells in the interstitial tissue, has not yet been determined.

"Section of *peripheral nerve-fibers* is followed by their rapid degeneration from the point of section to their peripheral terminations. The degenerated peripheral nerve-fibers are replaced by new axis cylinders, which grow probably from the intact axis cylinders of the central portion of the nerve. These axis cylinders subsequently become invested with myeline and tubular sheaths. There is no conclusive evidence that nerve-elements are regenerated in the central nervous system of the adult. This is especially true as regards the reproduction of ganglionic cells."

Hypertrophy.—The term hypertrophy is applied to enlargement of a part from an increase of its normal constituents, the structure and arrangement remaining essentially unaltered. Parts which become enlarged in consequence of a deposit of materials foreign to their composition, or from disproportionate excess of certain of their normal constituents, are not, properly speaking, hypertrophied. Two forms of hypertrophy have been distinguished—namely, *simple* or *true hypertrophy*, and *numerical hypertrophy* or *hyperplasia.*

"In simple hypertrophy there is an increase in the size of the anatomical elements, but not in their number; in hyperplasia, the number of those elements is augmented. These two forms of hypertrophy are frequently -bined. Hypertrophy may proceed from a diminution of the disintegra- or waste naturally incident to the life and activity of the cells, while the

process of assimilation continues in normal force; but it more frequently results from an excess of appropriation by the part of nutritive supplies. This excess of nutriment is generally consequent upon exaggerated and prolonged increase of the function of the part. The most frequent examples of hypertrophy are the physiological hypertrophy of the voluntary muscles following persistent exercise, and the pathological hypertrophy of the heart when it is called upon to overcome abnormal obstacles to the circulation, such as are presented by valvular lesions. Examples of hypertrophy like the last mentioned are conservative, and conduce to the welfare of the body."

Tumors.—Tumors constitute pre-eminently the pathological new growths. Tumors are composed of anatomical elements similar to those normally present in the body. Morbid growths are now called homologous when their structure is similar to that of the parts in which they are developed—for example, a fatty tumor in adipose tissue.

The term heterologous is applied to growths differing in structure from the parts in which they are seated—for instance, epithelial tumors in connective tissue. Tumors are classified and named according to the physiological type of tissue of which they are composed. Mixed tumors are those in which two or more forms of tumor are combined. Cysts occupy a special place among the tumors. Many are to be ranked among the passive rather than the active alterations of the tissues.

An important clinical division of tumors is into *benign* and *malignant*. The signs of malignancy are the invasion of the surrounding tissues, the property of local recurrence, the formation of metastasis, and the development of cachexia. Benign tumors displace, compress, and perhaps lead to atrophy of the tissues in their vicinity; whereas those tumors which grow into and invade the surrounding tissues are generally malignant. Tumors which return to the same place after their removal are frequently, although not necessarily, malignant. Another evidence of malignancy is the development in various parts of the body of secondary or metastatic tumors of the same structure as the primary growth. The metastasis is believed to be due to the transportation of cells from a primary or secondary tumor by the blood or lymph current. The cachexia is now generally believed to be the sequel of the tumor, and not a primary dyscrasia. And malignant tumors are now thought to be of local origin. But transmission by inheritance has been shown to be an important predisposing influence in the development of some tumors, particularly carcinoma. Local irritation, such as results from injuries, has often been adduced as the cause of the growth of tumors; but this influence of pathological and physiological irritation has been, no doubt, much exaggerated, and at the most can be regarded only as an exciting cause. Cohnheim has recently advanced the hypothesis that all true tumors are the result of some abnormality in embryonic development. According to this theory, the germs of the tumor, probably consisting of misplaced embryonic cells, are brought by the individual into the world. They may remain dormant for a variable length of time, and then, under the influence of some exciting cause, possibly an injury, may begin to grow.

All tumors are recognized as circumscribed growths of new formation—i. e., somewhat independent of the general organism, but in structure have their types in some one or more of the normal tissues. Under this head are included the non-inflammatory growths.

Classification of Tumors.—Tumors have been classified according to their histological characters. The following classification, adopted in Gilliam's "Essentials of Pathology," appears to be in conformity to that which is in general use:

I. *Type of Embryonic Connective Tissues:*
   Type of granulation tissue........................Sarcomata.
   Type of mucous tissue........................Myxomata.

II. *Type of Mature Connective Tissues:*
   Type of fibrous tissue........................Fibromata.
   Type of adipose tissue........................Lipomata.

Type of cartilage.................................Enchondromata.
Type of bone.................................Osteomata.
Type of lymphatic tissue.........................Lymphomata.
III. *Type of Epithelial and Connective Tissues:*
Type of papillæ of skin, etc.......................Papillomata.
Type of secreting glands.........................Adenomata.
Type anomalous (of *epithelium?*)................Carcinomata.
IV. *Type of Higher Tissues:*
Type of muscle.................................Myomata.
Type of nerve.................................Neuromata.
Type of blood-vessels.............................Angiomata.

Of all varieties of tumor, sarcoma and carcinoma are undoubtedly the most important. Sarcomata are composed almost entirely of cells, and are classified according to the form of cell which predominates. An important general division is into small-celled and large-celled sarcomata, of which the former are usually the most malignant. The three leading varieties of sarcoma are, *first*, round-celled; *second*, spindle-celled, and *third*, giant-celled, or myeloid sarcoma. The cells are separated from each other by a small amount of inter-cellular substance. Where this is not present, the propriety of calling the tumor sarcoma, and not carcinoma, is questionable. Sarcoma is often combined with other forms of tumor, as in osteo-sarcoma, myxo-sarcoma, etc. As sarcoma springs from the universally distributed connective tissue, there is hardly any part of the body from which it may not take its origin. The giant-celled and the ossifying sarcomata generally spring from the bone or periosteum. It should be remembered that sarcoma embraces both benign and malignant growths. The smaller the size and the larger the number of the cells of the tumor, the more malignant and rapidly growing is it as a rule.

"The terms carcinoma or cancer are interchangeable; but other tumors, as well as cancer, may assume a malignant course. The essential feature of carcinoma is not the presence of any particular form of cell (*for specific* cancer-cells do not exist), but the arrangement of the cells in spaces called *alveoli* which lie imbedded in vascular connective tissue called *stroma*. The name alveolus, as here applied, is somewhat misleading, as the spaces may be of any shape or size, and always communicate with each other. Thus upon section the cancerous alveoli appear broad or narrow, round or elongated, or branching, and contain from three or four to several hundred cells. The cells within these alveoli are sometimes called the cancer-cells, in distinction from the cells in the intervening stroma. These cancer-cells may be of the most variable size and shape; they are at least larger than white-blood corpuscles, and in a general way may be said to resemble epithelial cells in shape. This resemblance is sometimes close, sometimes remote. In their relation to each other, however, the resemblance to epithelium is exact. The cancer-cells in an alveolus lie in close proximity to each other, not separated by any inter-cellular substance, or at least by no more than a scanty cement substance like that between epithelial cells. If the cells be brushed or shaken out of an alveolus, the space is found to be empty. All of the tissue between the alveoli forms the stroma, which consists of fibrillated connective tissue, usually very vascular and at times very rich in cells. An old and still employed classification of cancers is into *scirrhous*, *encephaloid* or *medullary*, and *colloid* cancer. This subdivision, not being based upon essential anatomical differences, is not very satisfactory. The terms *scirrhous* and *encephaloid* refer to the consistency of the tumor. A scirrhus is a hard cancer in which the *fibrous stroma* predominates; encephaloid or medullary cancer is soft, in consequence of the small amount of stroma and excess of cancer-cells. There is no essential structural difference between the two forms. The encephaloid cancer is naturally the most rapid in its growth and the most malignant. Its cells are usually smaller than in other forms of cancer. In colloid cancer the alveoli contain partly cells and partly a translucent, gelatinous material ·ich is thought to be derived by colloid metamorphosis from the cancer-ı. The alveolar structure of colloid cancer being generally evident to the

naked eye, this variety has received also the name of *alveolar cancer*, although, strictly speaking, every cancer is alveolar. The nature of colloid cancer, and even the propriety of classifying it with other forms of cancer, have not been established. It grows most frequently from the abdominal viscera or peritoneum, and is less malignant than other species of cancer."

A subject of great interest pertaining to the pathology of carcinoma relates to the origin of cancer-cells. It has been the teaching of Virchow, in accord with his scheme of pathogenesis, that cancer-cells develop out of connective-tissue cells. Recently, however (says Professor William H. Welch), the belief has been gaining ground that cancer-cells not only resemble epithelial-cells in shape and in relation to each other, but that they are actually the offspring of epithelial-cells, and that all varieties of cancer are therefore, strictly speaking, *epitheliomata*. It is an interesting fact that, as a rule, cancer-cells conform to the type of epithelium of the part in which they primarily grow. "In their growth the cancer-cells push their way especially into lymph-vessels and lymph-spaces, so that oftentimes the alveoli are dilated lymph-spaces. The metastatic or secondary growths, which are such a frequent accompaniment of cancer, preserve, with few exceptions, the type of the primary growth. The material, doubtless consisting of cells from the primary tumor which produces the metastases, is transported especially by the lymphatic vessels, so that the neighboring lymphatic vessels are early involved. The metastases may also occur through the blood-vessels, as is the rule with sarcoma. Carcinoma is purely local in its origin, and is not preceded by any dyscrasia. The cancerous cachexia follows the development of the primary and secondary growths."

Cancerous growths affecting mucous membranes generally run their course to a fatal termination in from six to eighteen months, and even scirrhus of the breast, if left untreated, does not usually last more than four years. Those interested in examining the advertisements and circulars of empirics who claim to cure cancer without operating, will find them reporting cures of cases of over forty years' duration. The natural duration of carcinomata shows very clearly that these long cases are benign tumors. As cancer most frequently develops after forty years of age, the time of life becomes an important factor in the differential diagnosis. Nevertheless, cancer may occur in early life. In fact, cancer of the kidney is more frequent in children than in old people. On account of the frequency of cancer of the breast and of the uterus, females are more subject to cancer than males. Carcinoma may grow from any organ possessing epithelium. Primary cancer of bone, lymphatic glands, serous membranes, and other parts devoid of epithelium, are certainly very rare. A frequent metamorphosis in cancers is fatty degeneration with disintegration of the cell-elements. In this way ulcerations are produced. By combined fatty degeneration and increase of the fibrous stroma, a cancerous tumor may be much reduced in size and activity, but it is doubtful whether recovery ever takes place in this way.

Tubercle.—The morbid products embraced under the name *tubercle* are of great importance, in view of the frequency of the affections in which they occur, and of the extent to which these contribute to mortality. The origin and nature of tubercle are much-disputed questions. But it is a singular fact that the tubercle almost invariably develops in the line of, and in immediate proximity to, the smaller blood-vessels. The result is that the vessel soon becomes occluded, the blood-supply is cut off, and the tubercle soon undergoes degeneration and death. In the intestinal canal the tubercular ulcer can be easily distinguished from others by its tendency to follow the vessels transversely around the bowel, sometimes forming a complete girdle. The secondary changes are atrophy, fatty degeneration, and disintegration. Tubercles are very small (individually), varying in size from microscopic dimensions to the size of a millet-seed, or larger. They exist without number, are localized or general, and are disseminated evenly or arranged in clusters. They are pellucid or grayish translucent. As regards the seat of tubercle, no part of the body is exempt, but the favorite seats are the meninges of the brain,

lungs, and intestinal canal. The formation of tubercle begins at distinct foci. The primitive tubercle is a microscopic body, and consists in greater part of corpuscles like blood leucocytes, or like the corpuscles of lymph and pus. The cells in tuberculous granulations are probably derived from *emigrated white-blood corpuscles*. This conclusion is warranted not only from their microscopical structure, but from their location in the vicinity of the capillary vessels, and also from the fact that their deposition is always preceded by certain premonitory symptoms, denoting an impoverished condition of the blood which first affects the nutrition of the vessel-walls, *thereby increasing their permeability*. Owing to this morbid state of the blood, not only is the extrusion of white corpuscles through the capillaries facilitated, but hæmoptysis due to diapedesis, and not a rupture of the blood-vessels, is known to be one of the first symptoms of tuberculosis. Every tubercle appears to present a giant-cell surrounded by lymphoid corpuscles, and many nuclei which make up the greater part of the tubercle. The primitive tubercle increases in size until it becomes visible to the naked eye. The enlargement is brought about by the formation of fresh tubercular foci around the original focus, so that when six or more of the primitive tubercles become agglomerated into one body, it becomes visible as a small nodule (tuberculum). Sometimes the agglomeration does not assume the nodular form, but is diffused and of irregular shape; this is called an infiltration. In regard to the lesions which surround tubercle, there are first present the mechanical effects of pressure. Next the lymphatics and juice-canals around are widened and filled with chylous material containing a few corpuscles. Tubercle is also commonly associated with surrounding hyperæmia and with inflammatory exudations in the neighborhood. These secondary lesions are well seen in the serous and mucous membranes. Pleuritis, pericarditis, and peritonitis, local or general, are sure to follow upon tuberculosis of the respective membranes. In mucous membranes, hyperæmia and catarrh are the necessary results. But in tissues which are themselves undergoing transformation into tubercle, an obliteration of the blood-vessels proceeds very rapidly. Tubercle, wherever formed, is non-vascular. At the very outset of tubercle deposit, as soon as the giant-cell becomes surrounded by the other nucleated cells, the wall of the blood-vessel in its vicinity disappears.

As tuberculosis is essentially a condition of malnutrition, sooner or later the tubercles undergo sundry regressive changes. This tubercular metamorphosis sometimes takes place very quickly, certainly within two or three weeks; and sometimes tubercle may remain unchanged for a long time, even two or three years, before it caseates. Preceding the cheesy metamorphosis, all parts of the tubercle become infiltrated with oily molecules. This change begins in the very center of the primitive tubercle. To the naked eye minute white specks appear; they become larger and more numerous, and at last coalesce. The oily change is incomplete; many of the cells simply lose water, dry up and shrivel, and thus undergo cheesy degeneration. The cheesy degeneration usually begins before the tubercle has reached the size of a millet-seed. Large nodules, produced by the aggregation of smaller cheesy nodules, may reach the size of a peeled horse-chestnut. This caseous tubercle is the crude yellow tubercle of the old authors. Caseous tubercle may result in the following changes: First, softening, by which a tubercular abscess is formed. The abscess, when superficial, bursts, and leaves a tubercular ulcer. When all the caseous matter has been cast off, the ulcer may heal, and so the local disease come to an end. But usually the ulcer steadily enlarges by the perpetual production and destruction of tubercles around it; this is phthisis in the anatomical sense of the word. The cicatrix tissue of tubercle has a tendency to contract strongly. Sometimes a dense fibrous tissue will form around the cheesy matter, whether softened or not. This capsulatum constitutes the encysted tubercle of Bayle. Another change is that of calcification, the oily particles becoming gradually replaced by carbonate and phosphate of lime. And, finally, absorption to a certain extent may . Perhaps cheesy glands may entirely disappear in this way. But, if

the current doctrine concerning the infectiousness of tubercle is true, absorption is, of all the terminations, the least to be desired.

The *tubercular diathesis* means a particular disposition to the generation of tubercles. It may relate to tissues, organs, or persons. The connective, and particularly the lymphadenoid, tissues are especially predisposed to tubercle. Of late years, tubercle has been found in sundry morbid tissues—as in scrofulous disease of joints, in scrofulous ulcers of the skin, in the walls of scrofulous abscesses, cutaneous or connected with caries of bone, and also in chancrous and cancerous ulcers. "The serous membranes (pleura, peritoneum, and pericardium) are a very frequent seat of tubercle; endocardium very uncommon; dura mater not very common; pia mater very common; the mucous membranes (alimentary, respiratory, and genito-urinary) very common; lymphatic glands most common; testes not uncommon; heart not very common; brain and spinal cord tolerably common." The tubercular diathesis, with respect to persons, is met with only in the scrofulous. No age is exempt from the possibility of tubercles; they are especially common in early life, and have been found even in the fœtus.

The term *tubercular dyscrasia* is applied to a qualitative lesion of the blood. The frequency with which tubercle implicates a number of organs in the same subject and at the same time is sufficient evidence that the common cause exists in the common bond of all organs and tissues—that is to say, the nutrient fluid. Experiments go to prove that, in any individual possessing a tubercular diathesis, any inflammation, set up in any way, may call forth tuberculosis. Recently, Koch has announced his discovery of a specific tubercular organism in tuberculous structures and in the sputa of phthisis. This organism is a slender, rod-shaped, motionless bacillus, which equals in length from one quarter to the whole of the breadth of a red-blood corpuscle. The presence of the so-called tubercle bacillus is admitted by other observers. Some credulous medical men, carried away by the novelty of the germ-theory, actually believe this bacillus to be the cause of tuberculosis, while the majority of the profession consider it the consequence; but many observers believe that it is neither. It should be stated, however, that most modern pathologists now accept the doctrine of the specifically infectious nature of tuberculosis, in so far as relates to the absorption of the germinal cells in miliary granulations and in caseous scrofulous glands by individuals possessing the tubercular diathesis. But the process by which tubercle is developed must be looked upon rather as the operation of a *morbid influence* than as a result of a specific virus. In short, the pathogenesis of tubercle is the result of malnutrition arising from an impoverished condition of the blood, allowing the extrusion, proliferation, and retrograde metamorphosis of its white corpuscles. The inflammatory conditions may act as exciting causes of the local deposit of tubercle, but most frequently the inflammatory changes are the effect of the morbid process, especially those of an ulcerative or necrotic character.

Scrofula.—The term scrofula has been long in use, and possesses a rather comprehensive and indefinite latitude of signification. It is applied to a diathesis, or constitutional condition, observed especially in young persons who are the offspring of tuberculous parents, or who are in bad hygienic surroundings. "Scrofulous persons are prone to inflammations, particularly of the mucous membranes, lymphatic glands, skin, and periosteum. These inflammations are of a chronic character; the exudations have a tendency to cheesy degeneration rather than to resolution or organization. The inflammatory products are rich in cells, many of which are larger than are usually present in inflammation. The lymphatic glands, especially those of the neck, enlarge, often coalesce with each other, and undergo cheesy metamorphosis. Hence scrofula may be considered an inflammatory process, characterized principally by the accumulation of cell-products in the tissues and their subsequent caseation. There is no effort at resolution, and none at organization. The resolution is not effected, because, in the first place, there is a deficiency of vascularity, and because the cell-products of scrofu-

lous inflammation are much larger than ordinary cells, many of them being multinucleated. On account of these properties, they can not readily re-enter and escape by the blood and lymph channels. Organization is not effected, because there is deficiency of vascular supply. There are few or no vessels to nourish the new-formed cells, and, by the accumulation of these latter, and their pressure on the vessels, the blood-supply is still further interfered with. Hence it is that they lie quiescent in tissues, neither able to develop nor escape, until, becoming starved, they suffer fatty degeneration, and, the watery portions being absorbed, a caseous mass remains. The various affections attributed to scrofula—such as the glandular swellings in the neck, cutaneous eruptions, and ophthalmia—often disappear as the individual grows older and the hygienic surroundings are improved. There is an intimate relation between scrofula and tuberculosis. The cheesy deposits in scrofulous lymphatic glands are generally tuberculous." Many writers do not recognize the existence of scrofula as a special cachexia independent of tuberculosis.

In 1875 Professor Samuel D. Gross read an exhaustive paper before the American Medical Association on the connection between syphilis, scrofula, and consumption, advocating the view that the two latter were the offspring of syphilis. Lugol, of Paris, and the late Professor Daniel Brainard, were advocates of the same theory, and many other eminent medical men, who have had extensive opportunities for observation, believed that secondary syphilis may be, and often is, the parent of scrofula and tuberculosis. It is no stigma to say that those affected with scrofula or tubercle have modified syphilis; for when their ancestry, both paternal and maternal, is counted back five or six generations, they amount to several hundred, and it is not improbable that one or more of them may have in some way, accidentally or otherwise, contracted the disease.

Syphilis.—By the term syphilis is meant a peculiar morbid condition mainly affecting the lymphatic system, communicable by contact with a breach of surface or by hereditary transmission. Syphilis is characterized by a period of incubation and (except in cases of inheritance) by certain changes at the seat of contagion, and in the proximate lymphatic glands. These are followed by an eruption of the skin and mucous membrane, and sometimes by lesions of the deeper tissues and viscera. A distinct interval of several days occurs between inoculation and constitutional infection.

It is now believed that the chancre is the first and only direct result of the application of the contagious influence, and that constitutional affection results through a gradual invasion proceeding from this point. Beale has demonstrated by microscopical observations that a living germinal cell possessing the power and properties of the human white-blood corpuscle, in so far as growth, movement, and proliferation are concerned, is the starting-point of syphilis; that this cell is much smaller and more active than the ordinary white corpuscle, and, though less tenacious of life, is still capable of maintaining its vitality after its removal from its seat of development and deposited upon another locality in which may be furnished a suitable pabulum for its growth, and that this cell is descended directly from degraded cell-elements of human origin. This degraded human germinal cell of Beale is represented as varying in size from a five thousandth to one hundred thousandth of an inch in diameter, with nothing in its composition or in its physical properties to distinguish it from the nuclei, the nucleoli, or the granular bodies of the normal white-blood cell. According to the views of Dr. Otis, when this degraded white-blood corpuscle (the syphilitic disease-germ of Beale) is deposited upon the surface of an abrasion, occurring as from a recent venereal accident, it is at once immersed in the tissue fluid which the abrasion furnishes, thus affording pabulum suitable for its continued growth and its rapid proliferation. Its contact with the wandering white-blood cells which the local irritation has drawn to the part is assured. The capacity of such cells [to r]eceive into their substance these almost infinitesimal germs, and to pro[lifer]ate at increased speed on account of their presence, is an assumption

warranted by well-authenticated microscopical investigations. Thus, in syphilitic inoculation, an increased local proliferation of the white cell-elements begins and goes on steadily until a nodule of induration is formed, which is the accepted characteristic of syphilis. This nodule is made up solely of white-blood cells and the product of new formation resulting from enforced stasis of these cells. The initial lesion of syphilis is thus shown not to proceed from a destructive process, but from a process of growth. And it is a well-known fact that the mass of cells thus proliferated may exist for weeks, and finally become absorbed without showing the slightest tenderness or tendency to ulcerative action; and yet the person upon whom such accident occurs becomes just as certainly and thoroughly the subject of constitutional syphilis as when the initial lesion was an open tissue necrosis. And, further, it is also found that when such tissue necrosis—or, more properly, necrobiosis—does take place in the uncomplicated initial lesion of syphilis, this accident is due solely to interference with the vessels of nutrition of the part, caused by the proliferation and packing of cells around the vessels in their walls and within their lumen, and not from any destructive property residing in the contagious element of syphilis. The period of so-called incubation of syphilis (really the time which intervenes between the date of inoculation and the implication of adjacent lymphatic glands) is occupied by a steady cell proliferation at the point of inoculation. The period of so-called incubation is longer or shorter in proportion to the distance of the surface inoculation to the nearest lymphatic vessel. During this period no physical evidence of any diseased action is ever seen in any other part of the body, and all claims as to the vitiation of the entire organism at the moment of inoculation are without the slightest foundation in fact. The period of incubation is shortest in those cases where the wound of inoculation is at a point corresponding to the most superficial distribution of lymphatic vessels, notably at the frænum præputii, where the lymphatics lie just underneath the epithelium. In such cases the duration of incubation may not exceed three or four days. The germinal cells are first taken up by the lymphatic vessels, thence by the lymphatic channels, and thence they gain entrance into the nearest lymphatic glands. Painless enlargement of lymphatic glands is suggestive of syphilis, and, when associated with a suspicious lesion upon the genitals, is accepted as a proof of the syphilitic cause of that enlargement. Microscopical examination of glands so enlarged shows them to be literally packed or stuffed with the products of cell proliferation, and that the swelling and induration are due to this cell accumulation, which is identical with that found in the initial lesion. The course of the proliferated cells is of necessity toward the great lymphatic reservoir—the receptaculum chyli; but there is at least six weeks' delay in reaching it after the involvement of the lymphatic glands, which has completed what may be termed the *initiatory period of syphilis*. During this time the individual is free from every physical sign of syphilis and from all discomfort at every point, except, perhaps, that between the lesion of inoculation and the swollen indurated glands. Hence this has been called the second period of incubation. This delay in the passage of the proliferated cells is due to mechanical obstacles incident to the packing of the glands with these diseased cell-elements. Finally, their passage through the canals of the glands is effected along with the lymph-current, and poured with the normal lymphatic elements into the general circulation through the subclavian veins. Thus suddenly set free in the general blood circulation, we now, for the first time in the history of the infection, find evidence of constitutional disturbance, such as headache and general malaise, etc., called the syphilitic fever. The same cell accumulation now steadily progresses in the general lymphatic system—a system of vessels and glands, the known source of embryonal elements most necessary to the healthy nutrition and growth of the human organism. In addition to the roseola which appears to mark the general dissemination of the degraded or syphilitic cell-elements throughout the system, we now find enlargement and induration of lymphatic glands at a distance from those directly connected

by lymph-canals with the initial lesion. These, examined under the microscope, show the same cell accumulation that characterized the point of original inoculation and the glands first affected. As characteristic of this, the secondary stage of infection, congestion of the fauces and tonsils takes place, which may go on to ulceration. These parts are readily implicated because unusually rich in lymphatic vessels. The course of the syphilitic infection is now toward the periphery of the body. Carried by the outgoing blood-current from the center of the circulation into the most superficial cutaneous capillaries, the circulation becomes most sluggish, a condition known to favor activity of motion and proliferation of embryonal cells, and to aid them in wandering out of vessels and into tissues. Consequently, in the tissue-space intervening between the blood capillaries surrounding the papillæ cutis and the lymph capillaries passing up through these centers, we find an accumulation of cells similar to those found at the site of the original inoculation, and it is impossible, microscopically, to distinguish an isolated secondary papule from a commencing primary affection. Examination of the mucous patches and tubercles of this stage of syphilis under the microscope shows them to be only papules occurring upon mucous membrane and in places upon the skin subject to unusual moisture. The iritis characteristic of this stage is caused by a deposit of cells, and the so-called gummy tumor of the iris is simply a papule, a mass of hastily generated cells developing in a locality, the anterior chamber of the eye free from surrounding pressure, and thus assuming the well-known irregularly nodulated form.

"The alopecia of active syphilis is due to the deposit of cells in the tissue spaces of the hair-bulbs sufficient to interfere with proper nutrition. Syphilitic onychia is dependent upon excessive localized cell accumulation in the nail matrix. In short, every known manifestation of syphilis in the skin, in the lymphatic vessels and glands, in the hair, in the eyes, in the nails, in the bones, has been proved beyond dispute, by competent microscopic examination, to be due to one and the self-same cause—viz., an excessive accumulation of white cell-elements. Wherever a syphilitic manifestation during this the active stage of the disease is found, a crowd of newly proliferated cells is found to account for it, and nothing else. The simple mechanical pressure in the tissues and in the vessels of nutrition of every affected part is in sufficient degree to account in a rational way, not only for every possible variety of initial lesion uncomplicated with other disease, but for every variety of constitutional manifestation ever known to occur during the active or so-called secondary period of syphilis, and this, too, in complete accord with known physiological processes and in harmony with recognized physical laws." In this view of the case, the so-called virus of syphilis is without meaning. The ætiological factor is simply an influence and not a physical entity, and it should be stated that this influence is inherent in all cells, whether healthy or degraded. According to Rindfleisch, a contagious element, an infectious principle, exists in the normal or healthy development of tissue in all cases where embryonal formative cells and colorless blood corpuscles come in contact with those of a higher type of development. Shall we then, because a similar influence is shown to manifest itself in a diseased condition of cells, insist that a separate influence, a mysterious and invisible, possibly a tangible, virus must have been developed to account for it? Since it is now proved beyond question that the nature of the material constituting syphilis consists of human germinal cells in no known respect different from normal germinal cells, except that they are the product of a proliferation more rapid than that process under normal conditions, the only ætiological factor that we can recognize in its development is that of a perversion of nutrition. The necessary pressure exerted upon any local cell accumulation in the tissues tends toward its removal by fatty degeneration. Hence the natural tendency of all syphilitic lesions is toward recovery—to that process of fatty metamorphosis through which alone every living material, normal or abnormal, must pass before it can be eliminated from the living organ-

This natural tendency may and should be assisted by various external

and internal remedies which experience has found useful in producing or hastening fatty degeneration, or metamorphosis of tissue. After the lapse of a period, which varies usually from six to eighteen months, the secondary stage of syphilis comes to an end, and in many cases the disease troubles the patient no longer; but, if the proliferated cells fail to have undergone fatty degeneration and elimination, they may remain to obstruct the lymphatic system in its function of conveying to the general circulation waste material, as well as that which is exuded in the tissues in excess of the necessities of growth and repair. As a consequence of this lymphatic obstruction, we eventually have another set of lesions usually classed as *tertiary*, such as severe forms of eruptions called rupia, deep ulcers of the skin and mucous membrane, and diffused infiltration, or *gummata* of the subcutaneous and submucous cellular tissue, muscle, bone and periosteum, testes, brain and spinal cord, blood-vessels, and the internal viscera, of which the liver is most frequently attacked. The tertiary period is also often attended by severe cachexia, with a peculiar earthy pallor of the skin. The diseased conditions enumerated as characteristic of chronic or tertiary syphilis differ from acute syphilis in date of appearance, mode and locality of development, and in the entire absence of the contagious syphilitic element. Microscopic examinations have brought to light the important and interesting fact that all the various tertiary lesions (sequelæ) of syphilis are characterized by the presence of a peculiar material, which, from its physical properties, has received the name of "gummy material." This material has been proved, by repeated and exhaustive microscopical examinations, to be made up of gelatinous fluid containing normal cells and nuclei, which do not differ in the least demonstrable degree from the white-blood cells and nuclei of a healthy person. The gummy growth may develop in a diffused or in a circumscribed form. When the circumscribed form is developed in the skin itself, it is known as a *syphilitic tubercle*, and when in the cellular tissue as a *gumma*. Gummata vary much in size. At first they are small, hard nodules, freely movable beneath the skin; but after a time they enlarge, soften, and become adherent to the discolored integument, which finally gives way, exposing a mass of yellowish-white material, which is gradually cast off in the form of *débris* and thin, ill-formed pus. The cavity then heals by cicatrization, leaving a depressed scar. Any of the structures of the body may be affected by this lesion; thus bone, muscle, the blood-vessels, and the internal viscera are all liable to suffer; and, although the morbid growth is essentially the same wherever developed, it, of course, presents differences in appearances, according to the particular tissue or organ affected. In its typical form it appears as a yellowish, tough, somewhat elastic and sharply circumscribed mass, varying usually from the size of a buckshot to that of a large chestnut. It is also often caseous in the middle and is surrounded by a highly vascular fibrous investment. Fibroid indurations and scarring are not uncommonly discovered in the organs of syphilitic subjects. *Lardaceous disease* is frequently caused by chronic syphilis. In fact, this is the most common visceral affection found in the bodies of old syphilitic persons.

Passive Alterations of the Tissues.

The passive alterations of the tissues may now be considered under the heads *atrophy*, *necrosis*, *degenerations*, and *infiltrations*.

Atrophy.—"The term *atrophy* expresses a condition the reverse of hypertrophy. In atrophy the histological elements of a part diminish in size or in number without undergoing further change in structure. Diminution of volume and of weight characterizes atrophy, unless a deposit of fat or some other substance compensates for the loss of material. An atrophic organ is generally dry, firm, and anæmic. Atrophy may be a *physiological* process, as is the case with the normal involution of the thymus-gland and of the female genital organs. Senile atrophy is also, perhaps, to be included in the physiological atrophies, although *pathological* causes are also present. *An insu*

cient supply of nutriment is a most efficient cause of atrophy, both local and general. Examples of local atrophy due to this cause are the wasting of the hepatic parenchyma in cirrhosis of the liver, and the atrophy of parts subjected to pressure (compression atrophy). A general atrophy, although in unequal degree of the organs and tissues of the body, is the result of insufficient supply of food and of mal-assimilation. *Functional inactivity* is another cause of atrophy. This atrophy may be explained by the diminished blood-supply which is known to attend suspended function. As examples of this functional atrophy may be cited the wasting of the muscles in paralysis, of the bone in anchylosis, etc. *The withdrawal of nervous influence* may be a cause of atrophy. In atrophy of the kidney and sometimes in muscular atrophy, especially in pseudo-hypertrophic paralysis, an excessive deposit of fat occurs about the kidney and between the muscle-fibers.

Necrosis.—"The death of any part of the body may be termed *necrosis.* The causes of necrosis are, *first*, arrest of the circulation, and, *second*, agencies which destroy the vitality of the cells. The causes which arrest the circulation may act primarily on the arteries, veins, or capillaries. Obstructions in the arteries lead to necrosis in situations where no sufficient collateral circulation can be established, as in the kidneys, spleen, and some parts of the brain. Arterial obstruction in other parts—for instance, in the extremities—also, may occasion local death when the arteries are extensively diseased or the circulation feeble. The most important element in the production of *senile gangrene*, which affects by preference the lower extremities, is extensive atheroma of the arteries. Venous obstruction rarely leads to necrosis on account of the relief usually afforded by numerous collateral channels. If all the veins of a part be occluded, so that no return circulation can exist, necrosis follows, as in strangulated hernia and in the constriction of a part by a tight bandage, where also arterial is combined with venous obstruction. Obstructions in the capillaries are generally due to agencies which also impair the life of the tissue-cells—as, for instance, the compression exercised by exudations, tumors, etc. Most of the agencies which cause disintegration of the cells act also upon the circulation. This second group of causes includes mechanical violence, certain chemical substances, and extreme heat and cold. Chemical substances act either by withdrawing water from the tissues or by entering into chemical combinations with the histological elements. The gangrene of the extremities which follows the prolonged ingestion of ergot is usually attributed to the contraction of the small arteries induced by this substance. The parts of the body differ normally in their power of resistance to agents causing necrosis. Under pathological conditions this resistant power may be so diminished that comparatively slight causes occasion necrosis. Thus, in feeble, bed-ridden persons moderate pressure and uncleanliness may suffice to produce necrosis in the form of bed-sores. These lesions may occur in a very short time, even in twenty-four hours after injuries and diseases involving the gray matter of the spinal cord. This acute necrosis is attributed to *neurotrophic* disturbances. Diabetes mellitus is a disease in which the resistant power of the tissues is weakened, and in which gangrene sometimes occurs. As there are many causes, so there are many forms in which necrosis appears. In the first place, a necrosed part may preserve nearly its normal appearance. This is true only of certain hard resistant substances, such as bone, cartilage, and tendon. An important distinction is that between *simple necrosis* and *necrosis with decomposition*. The latter is usually called *gangrene*, although this term is also often applied to forms of simple necrosis. One form of simple necrosis of the exposed parts of the body is called *dry gangrene.* In such cases the dead tissues dry up, shrink, and assume a dark color. Evaporation is greatly favored by loss of the epidermis. If the necrosis be accompanied by putrefaction, we have *moist gangrene.* In this form the affected part is [...]nid, of a dark color from diffusion of blood-pigment, and of a penetrating [...]. Bubbles of gas, composed of ammonia, sulphuretted hydrogen, and [...]r substances, are generated in the tissues. Necrosis with decomposition

is usually met with only in parts of the body exposed to the air, as the extremities, the lungs, the uterus, etc. If decomposition accompany necrosis in other parts of the body—for instance, the brain—it is in consequence of the transportation thither of some putrescent material, such as that carried by emboli from ichorous thrombi. A necrosed mass of tissue is called a *sphacelus*, or *slough*. Necrosis of the internal organs not exposed to air may be in the form of simple softening without any attendant decomposition. A good example of this form of simple necrosis is the ordinary embolic softening of the brain. One of the most important and interesting of the forms of necrosis is that to which Cohnheim has given the name *coagulation-necrosis*. Coagulation-necrosis consists in the transformation of protoplasm into a non-nucleated, coagulated, albuminous material, resembling, if not identical with, fibrin. This coagulation may occur in all kinds of tissue the cells of which, possess coagulable protoplasm; and it may be an element in a variety of pathological processes. The nature of this process is believed to be similar to that of the formation of fibrin from the blood. The presence of a so-called fibrin ferment is essential for the coagulation of fibrin; in addition to which the fibrinogenous substance must be present. The ferment referred to is furnished by the destruction of white-blood corpuscles. An essential condition, therefore, for this transformation of cell-substance, called coagulation-necrosis, is death of these cells under circumstances and places in which they can be permeated by fluid containing the fibrinogenous substance. This condition is best fulfilled when these cells die in living tissues through which is constantly passing the lymph or serous transudations from the blood. There are certain influences which prevent coagulation when the conditions otherwise are present. Of these unfavorable influences may be mentioned suppuration, and the preservation of epithelium, of mucous membranes, etc. The white infarctions which follow embolism of branches of the renal or splenic arteries afford an example of coagulation-necrosis. To the naked eye these infarctions are light in color; they are firm, and present in their periphery not infrequently a hæmorrhagic zone, which does not extend into the interior in consequence of the resistance offered by the firmly coagulated mass to the entrance of the blood. Microscopical examination shows that the cells in the anæmic district have lost their nuclei. At first the cell-contours are preserved, but subsequently the cellular outlines are destroyed. It is the loss of the nuclei which constitutes the most striking microscopical change, the chemical alteration in the protoplasm being less evident. Leucocytes with intact nuclei wander in from the periphery. This anæmic necrosis is also present, but to a less extent, in pulmonary infarctions. In the anæmic softening of the brain there is no coagulation, in consequence of the absence of a sufficient amount of coagulable protoplasm. The so-called caseous metamorphosis in syphilitic gummata and in tuberculous and scrofulous products belongs to the domain of coagulation-necrosis. Coagulation-necrosis may attack individual cells as well as masses of tissue. In this respect the parenchymatous cells of an organ are less resistant than connective-tissue cells. In croupous and in diphtheritic inflammations there is coagulation-necrosis of the epithelium of the affected mucous membrane, in the latter process combined with necrosis of the subjacent tissues. The formation of small-pox vesicles is preceded by coagulation-necrosis of the lowest cells of the rete Malpighii. The so-called waxy degeneration of the muscles, such as occurs in typhoid fever, is apparently a coagulation-necrosis. Coagulation-necrosis of the white-blood corpuscles, resulting in their disintegration, occurs in white thrombi, and, in fibrinous exudations, upon serous membranes. Coagulation-necrosis and fatty degeneration may be associated."

Infiltrations and Degenerations.—The remaining passive alterations of the tissues, or regressive metamorphoses, have been divided, theoretically, into the *infiltrations* and the *degenerations*. Infiltration is a term ordinarily applied to the deposition of some material in or between the tissue-elements. In degeneration there is a metamorphosis of cell-substance into new mate-

rial. This after-formation is of a retrograde character. But existing pathological knowledge does not enable us always to carry out strictly the distinction between infiltrations and degenerations of tissue. And these terms are sometimes applied to processes the nature of which is not thoroughly understood; hence the propriety of designating whether certain morbid processes are those of infiltration or degeneration is not established. The character of an infiltration is apt to be that of degeneration; but degenerations are not always infiltrations.

Parenchymatous Degeneration.—"The names parenchymatous degeneration or inflammation, albuminous infiltration, granular degeneration, and cloudy swelling are used as synonyms for the same metamorphosis. This change consists in the appearance in cells, and sometimes in intercellular substance, of numerous albuminous granules. Especially subject to this alteration are the muscular fibers and the parenchymatous cells of the glandular organs, particularly the renal epithelium, the hepatic cells, and the peptic cells. The affected parts appear swollen, opaque; and the normal outlines, as of the hepatic acini and of the renal striæ, appear obscured. Microscopical examination shows the cells swollen and filled with fine granules. The muscular fibers of the heart are prone to this change. They then contain albuminous molecules, which obscure the normal striation. The cells in inflamed parts undergo parenchymatous degeneration. Of the general causes may be mentioned infectious diseases—such as typhus and typhoid fever, pyæmia, puerperal fever, diphtheria, and poisoning with phosphorus, arsenic, and the mineral acids. *The view of Liebermeister, that parenchymatous degeneration is solely the influence of high temperature in general diseases which causes this metamorphosis, has been abundantly disproved.* Cloudy swelling is sometimes followed by fatty degeneration. If its causes disappear, there is usually a return to the normal condition. Parenchymatous degeneration undoubtedly impairs the function of the affected parts.

Fatty Metamorphosis.—"The fat of the body is derived, on the one hand, from oleaginous articles of diet, and, on the other hand, from the transformation of albuminous constituents, either of food or of cells. The carbohydrates favor the accumulation of fat by preventing its oxidation, not by directly producing it. There are certain natural reservoirs or dépôts for the physiological accumulation of fat. Of these, the most important are the connective tissue in certain parts of the body, particularly adipose tissue; also, the marrow of bone, the liver, the sebaceous glands, and, during lactation, the mammary gland. In these parts, especially in the liver, it is often difficult to distinguish between a normal and an abnormal deposition of fat. Under pathological conditions fat may appear in situations where it does not normally exist—for instance, in muscular fibers. Under normal and pathological conditions the fat is deposited chiefly within the protoplasm of cells. It is customary to distinguish between *fatty infiltration* and *fatty degeneration.* In fatty infiltration, or fatty growth, the fat has been believed to come from without the cells, and to infiltrate them in the form of large drops; and in fatty degeneration to be derived by direct metamorphosis from the cell-substance and to appear in the form of molecules. But these distinctions can not be maintained. Thus, in so-called fatty infiltration, while the fat may be derived from without, it is equally certain that it may be produced directly from the protoplasm of the cells. In fatty infiltration of a cell the protoplasm is displaced by the fat, but does not suffer materially in its integrity, except by a slow process of atrophy from compression; if the fat be derived from the albuminous constituents of the cell, these are, in great part at least, renewed. In fatty degeneration, on the other hand, the cell-substance is directly converted into fat, and is not at all, or only insufficiently, regenerated. Hence fatty degeneration is also called fatty atrophy. A considerable degree of fatty infiltration may exist without interfering materially wit' the function of the affected cells, although in extreme degrees this must suffer. But fatty degeneration is a much more destructive process, and interres to a much greater extent with the function of the cells. In fatty infil-

tration it appears that the fat is deposited at the expense of the water of the tissues, and in fatty degeneration at the expense of the solid constituents. In fatty infiltration the amount of fat is generally much greater than in fatty degeneration. But it is not always possible to draw a sharp line of distinction between fatty infiltration and fatty degeneration. In determining the nature of the process, it is of the greatest importance to take cognizance of the cause. The accumulation of fat in the organism is always the result of its incomplete oxidation. The causes of fatty metamorphosis, therefore, are, *first*, excessive supply or excessive formation of fat, and, *second*, diminished oxidation of fat. Too abundant ingestion of rich food, especially of fat and of carbohydrates, leads to *obesity*, or the excessive accumulation of fat in its natural dépôts. Constitutional peculiarities, often hereditary, the nature of which is not understood, favor the development of corpulence. An excessive formation of fat seems to be sometimes the result of increased nutritive activity, as in growing cells. The causes leading to diminished oxidation of the fat may be general or local. The general causes are, *first*, interference with the absorption of oxygen, in consequence of disease of the respiratory organs; *second*, diminution of the hæmoglobin of the blood; and, *third*, agencies which check the normal oxidizing processes. Diseases of the respiratory organs in themselves rarely ever lead to fatty metamorphosis, but they increase the efficiency of other causes. The various agencies which diminish the number or impair the quality of the red-blood corpuscles, these being the carriers of oxygen, are important causes of fatty degeneration. In this group of causes are to be reckoned progressive pernicious anæmia, icterus gravis, and other diseases attended by profound anæmia, as leucocythæmia, chlorosis, chronic pulmonary tuberculosis, and in less degree other chronic cachexia. Phosphorus and some other poisons lead to destruction of the red-blood corpuscles and consequent fatty metamorphosis. The use of alcohol favors the accumulation of fat by diminishing its normal oxidation. The parts which are most subject to fatty degeneration from general causes are the liver, the kidneys, the muscles—especially the cardiac muscle—and the coats of the small arteries. Local fatty degeneration can be attributed generally to an insufficient supply of oxygenated blood. In cirrhotic livers the hepatic cells are often fatty from the interference with the circulation through this organ. Pus-cells are usually fatty from imperfect nutrition. For the same reasons other inflammatory exudations undergo fatty degeneration. The opaque ring so often observed in the outer margin of the cornea of old people, and called *arcus senilis*, is due to fatty degeneration of the corneal corpuscles. A fatty organ is generally anæmic, of a yellowish color, and of diminished consistence. In fatty degeneration of muscles, the fibers contain numerous molecules and small drops of oil; the striæ are obscured and may disappear. In the fatty infiltration of muscles the fat is deposited always in large drops in the cells of the interstitial tissue, and not in the muscular fibers. In fatty degeneration the cells may be completely destroyed, leaving only a fatty detritus."

Mucoid degeneration consists in the transformation of the albuminous constituents of cells or of intercellular substance into mucin, which gives the tissues a gelatinous, translucent appearance. Mucin is an albuminous substance, devoid of sulphur, only held in solution by an alkali, and therefore precipitated by acetic acid, in an excess of which it is insoluble. It is normally secreted by epithelial cells of mucous membrane; also by certain glands, and it is widely distributed in the embryonic tissues. Pathologically, mucin may appear in abnormal amount in consequence of excessive metamorphosis in the epithelial cells which secrete it; but it may also be the result of mucoid transformations of the intercellular substance. The mucoid changes occur occasionally in cartilage, the marrow of bone, and especially in tumors. In the myxomata the intercellular tissue is composed chiefly of a substance containing mucin.

Colloid Metamorphosis.—"The colloid metamorphosis is allied to the mucoid. It affects chiefly cells. The colloid material appears in the form of

drops, either free or within cells, and it may appear more diffusely. It is of firmer consistence than mucin, contains sulphur, and is not precipitated by acetic acid. In its gelatinous, homogeneous appearance, it resembles mucin. The colloid material accumulates in great amount in the follicles of the thyroid gland in goitre. The colloid change may also affect the cells in tumors. Colloid cancer has already been mentioned. In ovarian cysts, a viscid, gelatinous substance appears, called *paralbumen*, which is regarded as a secretion of the lining epithelium. This paralbumen is precipitated by dilute acetic acid, but is insoluble in an excess of the acid.

Amyloid Degeneration.—"This degeneration, which is also called waxy or lardaceous, is characterized by the appearance, especially in the walls of the vessels, but also elsewhere, of a homogeneous, firm, inelastic, translucent substance, similar in its composition to the albuminous matters, but more resistant to the putrefaction and to the action of the gastric juice. The most important property of this new substance is its reaction with certain coloring agents, which are therefore employed for its detection. Treated with iodine, it is stained a mahogany-brown; with iodine and sulphuric acid, a blue color. The substance was called amyloid from its supposed resemblance to starch, but it is now known to be a nitrogenous substance. For detecting the amyloid degeneration with the naked eye, a solution of iodine alone (Lugol's solution) is most applicable. This waxy degeneration may be local, but it generally affects a number of organs. The parts most frequently involved are the spleen, liver, kidneys, lymphatic glands, and the intestinal mucous membrane. Other parts may be affected, as the large blood-vessels, the heart muscle, the supra renal capsules, and the small vessels in most organs. If the degeneration be well marked, the affected part presents a characteristic translucent, grayish appearance, and is usually more or less swollen. The waxy material is exceptionally deposited in large nodules, constituting the waxy tumors. As a rule, the degeneration appears first in the walls of the small arteries and about the capillaries; thence it may extend to the surrounding tissue, which in some cases appears to be primarily involved. It has usually been held that waxy degeneration may invade cells, connective tissue, and, in fact, nearly all the histological elements. The so-called structureless membranes, such as the membrana propria of the uriniferous tubules, may undergo the change. The waxy substance is often deposited in irregular clumps. The cells are compressed and atrophied. The vascular walls become converted into a hyaline, swollen mass, which encroaches upon the lumen. The endothelium is for a long time preserved, and the circulation continues until the vessel is nearly obliterated. The causes of waxy degeneration are chronic suppurations, particularly of bone, and certain cachexia, especially the syphilitic, the tuberculous, and in less degree the cancerous, the gouty, and the malarial. In rare instances no apparent cause can be assigned. The degeneration may develop within a few months from the onset of suppurative processes. It appears, as a rule, at first in the spleen. Waxy degenerations are associated with severe wasting diseases. In the kidneys the condition seems to be always connected with more or less change in the interstitial tissue and in the epithelium. Waxy degeneration of the intestine leads to chronic diarrhœa. The source of the waxy material is not known, whether from the blood, or from the albuminous substance in the tissues. In various parts of the body there may appear, both normally and pathologically, spherical or irregular masses, which usually present a concentric arrangement, and which are called *corpora amylacea.* They often assume a blue color when treated with iodine or with iodine and sulphuric acid. They are not known to have any relation to waxy degeneration. So far as ascertained, they have no pathological importance. They occur especially in the prostate gland and in the central nervous system, in the latter being particularly numerous in chronic inflammatory processes.

Calcareous Degeneration.—"An infiltration of the tissues with the phosphate and carbonate of lime, mingled usually with the same magnesia salts, constitutes what is called calcareous degeneration, calcification, or cretefaction.

This change is not to be confounded with *ossification*, although the latter term is often applied to it erroneously. In ossification there is a formation of true bone. In calcification the salts of lime are deposited at first in the form of irregularly scattered granules, which appear dark by transmitted light and bright by reflected light. Large calcareous masses may be formed by increase in number and size of the granules. Calcified tissues are recognized by their hard, sometimes stony, consistence, and by the solubility of the earthy salts in strong acids, usually with the evolution of bubbles of gas. The salts are deposited chiefly in the intercellular substance; but the cells may also become infiltrated. The causes of calcification are, *first*, excessive quantity of earthy salts in the fluids of the body; *second*, diminution of agents which normally hold in solution the salts of lime, particularly of free carbonic acid; and, *third*, transformation of soluble lime-salts into insoluble modifications."

Virchow has described, under the designation *lime-metastases*, the deposit of the salts of lime in various parts of the body, particularly in arteries, lungs, and stomach, in cases of extensive caries and in cancerous disease of bone. This calcification he attributes to the presence in the blood of an absolute excess of lime-salts, derived by absorption from the diseased bone. But, with the exception of such cases, it does not appear that calcareous degeneration can be referred to an abnormal amount of lime in the blood. The other causes of calcification are believed to be operative when the salts of lime are locally deposited in tissues as a result of impaired nutrition. In the vast majority of cases, lime is deposited in tissues previously diseased. Especially prone to calcification are tissues which have undergone fatty degeneration, or coagulation-necrosis, as the result of anæmia. We find calcific deposits in cheesy masses, in old inflammatory products, desiccated pus, in tumors, and in and about parasites. Of great practical importance are the calcification of the cardiac valves in chronic endocarditis and that of the arteries, with or without inflammatory changes. Calcification of the middle coats of the arteries belongs among the usual changes in old age. What is usually called calcification of cartilage is ossification, or a change preparatory to ossification. Calcification may be a conservative process, as that of tubercle or when it checks the growth of tumors; or it may be detrimental, as when it affects the arteries or cardiac valves.

The Febrile Condition.

A morbid condition, which can neither be classed exclusively as a pathological state of the blood nor of the solid tissues, but one which, in its causation and effects, may involve both, is known as *fever*, or *pyrexia*. This morbid condition is characterized by an increased temperature of the body, together with acceleration of the circulation, loss of appetite, thirst, muscular debility, mental weakness, lassitude, and derangement of the functions of most of the important organs of the body. This rise of the temperature of the body, when it attains a certain height and lasts for a certain time, is accompanied by functional and structural derangements attributable to the febrile condition itself, and which are, in a measure, independent of its initial cause. From the earliest periods in the history of medicine down to the present time there has been no subject presented for the investigation of medical men of more vital interest than that of fever. It is the most important, because the most universal and the most dangerous of all the morbid affections of which the human body is susceptible. Its presence characterizes a great number of diseases; and in others, which are not for the most part attended by it, the physician must always be prepared to expect its occurrence. For it is that *pathological condition* by the presence or absence of which all his views of treatment are to be regulated, and the rise, progress, and termination of which he should watch with the closest attention, for by its degree and persistence he is enabled, in a great measure, to estimate the danger in each particular case. Some idea may be forme

of the great mortality of fevers by examining the mortuary statistics throughout the world. From these it has been calculated that two thirds of mankind die of acute febrile diseases properly so called, and two thirds of the remainder of that lingering pyretic malady, tuberculosis. Fever has proved in all ages a fertile theme for pathological speculation, and the attention that it has received from every medical author, both ancient and modern, would alone be sufficient to impress upon any one the importance of the doctrines it embraces. But how difficult is the study of this morbid process may be inferred from the fact that so much has been written concerning it, yet there is no one subject in the whole domain of medical science which still involves so many points of controversy. Any approximation, therefore, toward the correct doctrines of fever must be considered of paramount importance, constituting to a great extent the foundation of all pathological reasoning. Fever plays so important a part in acute disease generally, and is accepted so universally as a mark of the severity of the disease, and so often presents itself as apparently the chief antagonist with which the physician or surgeon has to contend, that the attempt to penetrate the secret of its essential nature has always been a favorite task; and so, for this reason, every school in every age since the dawn of medicine has had its theory of the febrile process. It is only, however, within comparatively few years that exact measurement of the body-heat by the clinical thermometer, combined with chemical examination of the various excretions at different temperatures, and aided by the experimental methods of investigation, has furnished the proper evidence to enable the pathologist to give a more accurate explanation of the rationale of the febrile condition.

The importance of fever is equally great whether we regard it as a symptom, an effort of restitution, or a morbid process with destructive tendencies.

Fever is distinguished as symptomatic when it is developed upon a local inflammation. And it is said to be idiopathic or essential whenever it can not be attributed to any local cause. A symptomatic fever, as its name denotes, is only a symptom of disease, an effect, or connecting link in a chain of morbid events, but does not constitute *per se* the disease. An idiopathic fever is, however, reckoned as a disease.

The most advanced views of pathologists concerning the nature and mechanism of fever may be briefly expressed as follows: "In every attack of fever there are traceable the three stages of invasion, domination, and decline, with or without an antecedent period of incubation. They may all run through in the course of a few hours, as in a paroxysm of ague, or they may extend over weeks. The period of invasion is characterized by a rising internal temperature, while the surface may remain cold and pale, the patient feeling chilly and suffering from rigors or shivering; the pulse is frequent, but generally small and long, from contraction of the arteries. During the dominance of fever the temperature remains high, the skin is hot, and the shiverings are replaced by a subjective sense of heat; the pulse is now full and bounding, from relaxation of the arterial wall. The decline is indicated by a falling temperature, a softer and less frequent pulse, and by a return toward normal conditions generally; it may be initiated or accompanied by a critical sweat or other evacuation. Death may take place at any period of the disease."

Fever is a preternatural evolution of animal heat. In the normal state the main source of animal heat is blood and tissue combustion. It has been found that the changes which evolve heat are most active in muscle, in the nervous structures, and in the abdominal viscera. The skin, on the other hand, is the great cooling agent; there is but little combustion of its structures, and it is continually losing heat by conduction when the surrounding temperature is low, but still more abundantly by evaporation under all conditions of external atmosphere. The distribution of the blood, superficially or deeply, is regulated by the vaso-motor nervous system, but heat production in muscle or gland is not directly proportionate simply to the amount of blood circulating through it; tissue combustion and consequent evolution of heat are

excited or repressed by cerebro-spinal nerves not governing the arteries. The nervous system thus intervenes directly in heat production as well as indirectly through its influence on the circulation, and it has been shown that the stimulus to tissue change and heat production is a reflex from peripheral impression, and there is reason for believing the existence of special thermal nerves and centers.

Taking the abnormal development of animal heat as the characteristic of fever, the first question which arises is whether this is due to increased production of heat, or to diminished loss. "While diminished circulation in the skin in the early stage will obviously tend to retain heat within the body, there is no room for doubt that there is increased heat production; the temperature rises in spite of profuse perspiration, when, of course, heat is very rapidly lost, as in acute rheumatism, or when perspiration has been induced by jaborandi before a paroxysm of ague; and it has been shown by direct experiment that in fever a patient raises the temperature of a given quantity of water, in which he is immersed, more quickly and to a higher point than in health." Such proofs are sufficient refutation of the hypotheses which explain the heat of fever solely by diminished escape of heat from the body.

It is now regarded as certain that the immediate cause of the increased generation of heat is due to a morbid activity of molecular changes incident to disintegration of tissue, or, in other words, to increased blood and tissue oxidation. "This is shown by the increased products of combustion given off in the different excretions. The febrile elevation of temperature is attended at once by increase in the amount of carbonic acid expired. A similar indication of increased tissue combustion is furnished by the urine. The amount of urea is usually absolutely increased, notwithstanding a diminished consumption of nitrogenized food; or, if the urea itself is not excreted in larger quantity, there is more nitrogenized waste in other forms. The total of nitrogenized matter contained in the urine is always augmented by fever."

"The real difficulty of the problem arises when we inquire what is the cause of the increased tissue combustion. It has already been stated that the distribution of the blood to the deep structures and organs and to the skin, respectively, is not a sufficient explanation of the physiological balance of heat; but it might be supposed that the greater rapidity of the circulation in fever, renewing the supply of oxygenated blood within the structures more frequently and more freely, would account for the greater oxidation. The rise of temperature, however, is not in proportion to the flow of blood through the vessels, and hyperpyrexia is often coincident with a failing circulation, the heat apparently in some cases actually increasing after death. One step toward the solution which may be considered certain is, that the nervous system is concerned in the maintenance of the heat in fever. Each disease has its own characteristic range and variations of temperature, and this fact alone—that febrile heat is not vague and irregular, but that there is the substitution of a morbid for a normal balance—is evidence of nervous control. Numerous observed facts and experiments point to the same conclusion. We need only mention the hyperpyrexia often resulting from injuries to the brain, and following section of the cord in the cervical region. Another item of positive knowledge obtained by experiment is, that pyrexia may be excited by the introduction into the blood of septic or other matters, which, it is important to note, need not be of formed material, but may be diffusible fluid. The increased heat may therefore be independent of capillary embolism and of bacteroid or other organisms.

"Now, in disease or after injuries, we have almost always both causes in possible operation—an entry or retention of altered organic matters in the blood, and an impression on the nervous system. In endeavoring to assign prominence to one or the other, we have, on the one hand, the teachings of antiseptic surgery, which demonstrate that absorption of putrescent discharges is the great cause of surgical fever, and, on the other, such facts as the hyperpyrexia of cerebral lesions, which can not be due to blood contamination. It still remains to be determined whether the presence in the blood of for-

Liebermeister, Zenker had demonstrated that the muscles undergo a peculiar granular degeneration in typhoid and other fevers, and the fact has been abundantly attested by later observers. Certain lesions common to all fevers —such as decrease in the fibrin and albumen of the blood, disorganization and serration of red-blood corpuscles, staining of the surrounding tissues with hæmatin, softening of the mucous membrane of the alimentary canal and the various organs—have also been noted. But whether these various lesions are *entirely due to an excessive and prolonged temperature*, or whether caused by some *toxic* or *infectious element in the blood* capable of producing both the fever and the destructive metamorphosis, is a point not yet fully determined.

In conclusion, it may be stated that, while this is not the place to elaborate the following propositions, they are respectfully submitted by the author for careful consideration, as tending to throw a light more clear upon the many occult mysteries of the febrile condition:

1. That while the occasional exciting causes of fever external to the body, and the predisposing causes relating to the individual, may comprise many and diverse factors, *yet the proximate cause is common to all idiopathic, non-infectious fevers.*

2. That the proximate cause of the essential fevers referred to is developed *within the body*, and that this consists in the accumulation of "*waste*" products and of azotized or unoxygenized material within the blood and tissues in a state of change or decomposition. The "waste" products constituting the *initial factor of the febrile process* by exerting a poisonous influence upon the nerve-centers, while at the same time the nutrient elements of the blood becoming unfit for assimilation in consequence of its contaminating effects extending to the arterial system, their oxidation takes place before reaching the tissues, and thus an additional impetus to that of tissue combustion in elevating the body-heat is established; and that this accumulation of the waste products is mainly due to defective excretion.

3. That when this azotized material has accumulated within the system more rapidly than its assimilation, its destruction and elimination by increased oxidation incident to fever becomes a supplementary effort of restitution, and hence, within certain limits, a conservative process.

4. That when continued idiopathic fevers are temporarily controlled by antipyretic remedies without promoting the excretions, their *duration* is necessarily prolonged.

5. That when the febrile condition is of hyperpyrexic degree, or even less, if long-continued, it becomes a morbid process with destructive tendencies, demanding antipyretic measures of treatment to antagonize the febrile process, but that such measures must be regarded as subordinate to those which *promote the removal of its proximate cause.*

6. That all essential fevers may have a *common proximate cause*, but the types and varieties may be determined by the impressions made upon the nervous system as influenced by the condition of the individual with reference to his powers of constitution, age, susceptibility, weakened condition of certain organs or tissues from previous disease or tolerance from like causes, as well as the character and degree of the defective excretion, and the route or channel by which the natural forces attempt its elimination.

7. That if the proximate cause of fever stated be retained in the system a sufficient length of time and exist in sufficient quantities, the normal embryonic or *germinal granules of the white-blood corpuscles* become infected by the toxic elements thus engendered.

8. That the proximate cause of all infectious fevers may be, and often is, of *autogenetic or spontaneous origin*, in consequence of these physiological products connected with living organization (these normal human organic germs) being partly devitalized by the poisonous elements within the blood, though still capable, when removed from the body, through the various excretions, and coming in contact in the right manner in susceptible indi-

viduals, of reproducing themselves and the fever which attends such reproduction.

9. That, in reality, no other so-called "germ" is to be recognized as an ætiological factor in contagious disease except those evolved from the animal body itself, and that the nature and the vehicle for contagion in all specific or infectious fevers is embodied in the semi-vitalized, granular matter of the white-blood corpuscles, which, through blood contamination, are rendered no longer fit for assimilation or tissue-building purposes, though still capable of proliferation and of exciting an inflammatory action or malnutrition in certain tissues and parts of the body in which they may find lodgment.

10. That this proximate cause (*contagia*) can only reproduce itself and the fever that attends such reproduction in another subject when the blood is in an unhealthy condition, suitable for zymotic action.

11. That, as these normal cell-elements become poisoned through defective excretion, it necessarily follows that the character of an infectious disease depends upon the variety or nature of that glandular excretion which is most defective; and hence it also follows that when these normal cell-elements become poisoned by an excrementitious material which has accumulated in the blood, they are most prone to elimination through those glands whose defective function has produced the blood contamination; and this explains the glandular involvement of infectious fevers.

12. That infectious fevers are propagated and determined, or made "specific," in obedience to the natural law of *elective attraction* which one tissue or part of the body has over another for the normal germinal or tissue-building cells of the blood, on the one hand, and, on the other, that *repellent force* exercised by various excretory glands by means of which material unfit to serve the purpose of nutrition is eliminated from the system. Hence it necessarily follows that in any so-called specific fever these embryonic cells of special tissues, now infected by the general toxic condition of the blood from "waste" material, become unfit for assimilation, but may yet remain living organic germs, still capable of *proliferation or multiplication*, and thus, by their presence and final regressive metamorphosis or elimination, produce, in part at least, those lesions which characterize the particular forms of infectious fever. And should these semi-vitalized, normal, human germinal cells, subject to this *morbid influence*, or while undergoing this regressive change, be transplanted to another individual whose blood is also contaminated with excrementitious material favorable for its continuance, similar phenomena and lesions are liable to be developed as were present in the individual from whom these diseased germinal particles have been derived. These morbid cell-elements, charged with excrementitious material, being still under the dominance of the natural laws of elective attraction, which appropriates certain elements to certain tissues or parts of the body, or that normal repellent force peculiar to certain excretory glands, secure their deposition in those localities or ultimate elimination (if the patient survives) through those excretory glands and parts of the body identical with those from which they have been derived. And thus, again, are stamped upon the disease its "*specific*" characters.

13. And, finally, according to the present view of the *rationale* of fever, it is very evident that an essential part of its treatment consists in the use of agents which act upon the nervous system in an inverse sense to the morbid influence, and thus tend to antagonize its effects and annul its baneful consequences. The modern view of the nature and mechanism of this pathological condition also teaches us that there are no "specifics" for the cure of idiopathic and infectious fevers; but that the most valuable medicinal agents are such as either allay nervous excitability or impart tonicity to the nervous centers until the so-called "vital forces," aided by remedial measures for exciting the excretions, are able to eliminate from the system the morbid elements which exert a causative influence.

Course of Disease.

By the course of disease is meant the mode in which its *symptoms* arise and succeed each other. And as the origin, succession, association, duration, and tendency of these phenomena vary exceedingly, and yet appear to be subordinated to general laws, a knowledge of these circumstances not only enables us to distinguish one disease from another, but often to anticipate their result in individual cases. A general consideration of the duration stages and termination of disease, therefore, is important.

Duration of Diseases.—The period intervening between the invasion and the termination of disease may vary in length from a few minutes to the greater portion of a lifetime; but experience teaches that nearly all diseases may be divided into two classes—namely, those which tend to terminate within a comparatively short period, and those whose duration is uncertain and indefinite. The former are termed *acute*, from a Latin word (*acutus*), which signifies sharp, brought to a point, and hence is expressive not only of the shortness of their course, but also of their sharpness or severity, since their general character, as compared with chronic diseases, is violence—a quality which, in many of them, is proportioned to their brevity. Instances of this fact are found in apoplexy and some other hæmorrhages, in cholera, and in peritonitis from perforation of the intestine; but the rule is not absolute, for several of the mildest disorders have the briefest existence, and, on this account, are called *ephemeral;* such are most of the slight inflammations of mucous membrane. It is, of course, impossible to fix a term within which all diseases shall be considered acute, but, by general consent, those are so regarded which do not extend beyond forty days; or, more precisely, the name is restricted to such as are not prolonged beyond about half the period named, and that of subacute conferred upon those which attain the farther limit.

"*Acute* diseases are of limited duration, and in many of them this is remarkably uniform, as may be illustrated by the acute specific fevers and acute idiopathic pneumonia. Even in such affections, however, there are deviations from the ordinary course, instances occurring in which the duration is longer or shorter than that usually observed, and this fact depends upon various circumstances, of which the most obvious are the intensity of the disease in any particular case, the previous condition and surrounding circumstances of the patient, the occurrence of complications, and the treatment adopted." Considering the number, the frequency, and the severity of acute diseases, it is remarkable that, in their sporadic form, they should be so seldom fatal. They very commonly evince a natural tendency to cure, which contrasts strongly with the more general direction of chronic maladies to a fatal termination. There is a class of acute diseases whose duration is so nearly uniform that it may be called definite. We refer to the *exanthemata*. In the large majority of cases, each one of their stages occupies a given number of days, so that the duration of the disease itself may be pretty safely predicted. The patient, however, may be more or less enfeebled, according to the severity of the attack and its complications. His recovery, therefore, does not always date from the cessation of the primary disease.

"Complaints which are *subacute* as regards their duration may be exemplified by many cases of whooping-cough and chorea, and by some cases of pleurisy, pneumonia, gastric or enteric catarrh, and certain skin affections."

Chronic diseases (Gr., χρονος, time) are those which are of slow progress, and exceed in duration the ordinary existence of the acute class. They may arise as consequences of acute disorders, or be developed originally in the form which they long afterward preserve. As a rule, their symptoms are not violent, and, if they cause pain, it is only at considerable intervals of time, or when they are approaching the fatal conclusion to which most of their number tend. They are, in the majority of instances, connected with some organic lesion—a fact which explains their ordinary result, as well as the general loss of health which the subjects of them experience. These affec-

tions are very apt to be complicated with acute diseases, either from the progress of the lesions which are peculiar to them, or from weakening of the constitution, and thus predisposing it to suffer from external morbid influences.

"A large number of diseases are *chronic* in their duration, and many of them, when once established, become permanent, while others are ultimately capable of being cured. As illustrations may be mentioned: organic diseases of the heart, most cases of phthisis, cirrhosis of the liver, chronic Bright's disease and rheumatism, dyspepsia, many skin affections, and also morbid growths in various structures.

"Some complaints, as regards their duration, can only belong to one or the other of the groups that have been mentioned, but a considerable proportion may in different cases be either acute, subacute, or chronic. Again, it must be borne in mind that a disease may be acute or even sudden in its origin, but afterward may subside into a chronic malady. Certain affections are chronic as regards their entire duration, but are characterized by the occurrence, at regular or irregular intervals, of acute or even sudden attacks, lasting a more or less definite time, which course of events is exemplified by cases of ague, epilepsy, and asthma."

Stages of Disease.—Pathologists usually divide the course of disease into three periods or stages: the first, that of *invasion* or *increase;* the second, that of *acme*, in which the symptoms reach their height and remain stationary; and the third, that of *decline*. But these stages are far from existing in all diseases, or of following one another in regular succession. It is only in acute diseases that they are presented with distinctness and regularity. There are some affections which may break out suddenly in their full force, so that the first stage is wanting, and others which terminate abruptly in death without any period of decline.

In others, again, there may be more than one acme, as in small-pox; for instance, active fever precedes the eruption, abates upon its appearance, and is again lighted up during the maturation of the pustules. Notwithstanding these numerous exceptions, some one stage, at least, is marked in every disease—that of invasion more frequently, perhaps, than the others. This one is highly important in its relations to diagnosis and treatment. In acute diseases the invasion is usually attended by a chill, followed by fever, nausea, vomiting, pain, and loss of strength; in children, convulsions are often the initial symptom; in females, syncope, and in many persons symptoms peculiar to the disease about to be developed, such as pain in some particular organ threatened with inflammation, pain in the loins preceding eruptive fevers, epistaxis before typhoid fever, etc. As the disease advances, the functions grow daily more and more disordered, the physiognomy more altered, the thirst more urgent, digestion feebler, the tongue fouler, the pulse more frequent, and the skin hotter. These changes are completed in the course of a few, rarely more than seven, days, and retain their severity, or experience a somewhat further aggravation, during another period and until the stage of decline arrives. The transition from the first to the second stage of growth to maturity, and even (though not so constantly) from the latter to decline, is so gradual and often imperceptible that it is not possible to say when the one ceases and when the other begins. During the stage of *decline* the symptoms begin to subside—the general symptoms first, and then those belonging more immediately to the local lesion, in case it is present. It is important in practice that temporary remissions be not mistaken for the permanent improvement which precedes convalescence—that the practitioner should not allow himself to be deceived nor induced, by apparent amelioration, to flatter the patient and friends with false hopes. Due regard must be paid to the period at which this improvement takes place, and to its maintaining itself for a reasonable time, before it can be considered as belonging to a regular decline of the disease. Convalescence is described by some writers as included in this stage, and although oftentimes, doubtless, the one passes into the other by insensible gradations, it seems more appropriate t

consider convalescence as one of the terminations of disease. The stages of chronic maladies are generally less distinctly marked than those of the acute; they are always of longer duration, and more liable to accidental modifications. The formative period is for the most part obscure, and may extend through many years; it sometimes, however, presents decided symptoms which clearly indicate the future disease. Thus, in pulmonary consumption, it is not unusual for hæmoptysis, or a mere loss of flesh without assignable cause, to precede by many months the proper symptoms of the malady; a similar remark is applicable to the several forms of cancer and to most of the organic diseases of the heart. In most of such examples the second stage consists merely of an aggravation of the symptoms observed in the first, together with a more distinct and characteristic display of local symptoms. The decline of these affections, when they tend to a fatal issue, is marked by the most striking symptoms, both local and general; the former vary with each particular malady, but several of the latter are common to nearly all internal chronic diseases, such as progressive emaciation, colliquative diarrhœa and sweats, and that breaking up of the constitution which is attended by hectic fever.

The characters of disease which have been described are modified by various circumstances. Thus diurnal changes appear to have a decided influence on the course of disease. Before daybreak, sweats are frequently observed both in acute and chronic disorders; this is the period in the twenty-four hours when the system seems most to require support, and there can be no doubt that the symptoms of nearly all diseases are aggravated at the close of the day, and usually continue to grow worse until after midnight. The sick, wearied with noise and movement and the light of the day, become exhausted, and at the same time restless and uneasy; as night advances, the fever increases, and with it the disturbance of the mind, which, in severe cases, attended by sleeplessness, is apt to pass into delirium. Some chronic diseases display their severity almost exclusively by night, such as rheumatism, especially of the syphilitic form; asthma, whether nervous or dependent upon emphysema of the lungs; aneurism of the great vessels; diseases of the heart; abdominal tumors and dropsical effusions which impede respiration in the recumbent posture, etc. Temporary changes in the weather, when sudden and extreme, and especially when they consist of a rapid transition from heat to cold, may often influence the course of disease and the regularity with which morbid phenomena are developed. Experience teaches that with hospital patients, when cold weather abruptly succeeds a moderate temperature, most of those who are in a very low condition die within twenty-four or thirty-six hours, a circumstance peculiarly noticeable in institutions which receive the aged only. Neuralgia and rheumatism are generally aggravated by cold weather, particularly if it be also damp. Spring and autumn, the seasons in which the greatest vicissitudes of temperature occur, are also those most prejudicial to chronic complaints. There is a popular notion that the sick from chronic diseases are very apt to die when the leaves fall and external nature tends to decay. A similar idea is entertained in regard to the boisterous month of March. Many consumptives look forward to its approach as the sure termination of their lives. During the entire cold season, chronic maladies are aggravated, and those not immediately fatal are infinitely more intractable than at any other time. So powerful is this influence, that the same remedies which have been fruitlessly employed during the winter seem to acquire new power on the approach of spring, in consequence of the disease then assuming a mitigated form.

Food and drink, labor and rest, pain and pleasure, mental excitement or depression, and many other analogous circumstances, have much influence upon the character and issue of diseases. The age of the patient plays an important part in regulating the duration of his disease. The diseases of infancy and childhood are, with few exceptions, short and active; those of old age, on the contrary, are more apt to be subacute and chronic. In the ·ly periods of life the severest symptoms are often followed by sudden and

unlooked-for recovery. "Childhood is the age of resurrection"; in advanced life the slightest attack of disease requires watching, for it is often the prelude to a fatal seizure. The diseases of males have, for the most part, bolder features and a more regular course than those of females, in whom the nervous temperament and disorders of the uterine system give rise to the most whimsical irregularities and the most unmanageable complications. Pregnancy is reputed to exert a strong control over many diseases, and even to have effected a cure in rheumatism, hysteria, insanity, cutaneous diseases, etc., and, what is still more surprising, to have suspended the progress of organic diseases. It is alleged that consumptive females often have the development of pulmonary tubercles arrested until after parturition, when disease resumes its downward course.

Termination of Disease.—"The endings of disease should be regarded both from a *pathological* and from a *clinical* point of view. Each pathological process or condition has modes of terminating peculiar to itself. Thus, inflammation may terminate by resolution, by the formation of different effusions or exudations, or by causing suppuration, softening, induration, ulceration, or gangrene. Fever, if it end favorably, may terminate by crisis, lysis, or a combination of these modes, or in an irregular fashion. An effusion of blood may remain more or less altered, may undergo organization, may soften and undergo a puriform change, may form a cyst, or may be altogether absorbed." The *clinical* terminations of diseases are highly important, and demand more consideration as regards the patient. All diseases ultimately end in complete or incomplete recovery or in death; but they do not always reach either point without passing through one or more of several intermediate gradations, which, relatively to the original disease, may be called terminations.

A large proportion of cases of disease end in *complete* and *entire recovery*, the patients being restored to their previous state of health and no organic mischief established. The *mode* in which this occurs is extremely diversified, for it varies with the organ affected and the nature and degree of the affection. Usually the constitutional symptoms are the first to disappear, pain, and the other morbid phenomena belonging to the nervous system, generally taking the lead; then the disturbance of the circulation ceases, the general operations of the economy resume their natural course, and, last of all, the injured organ regains its proper function. When the disease consists of constitutional disturbance alone—as in idiopathic fevers—the circulation and temperature give in general the earliest evidence of improvement, the pulse and temperature approaching more nearly to the standard of health; then follows the amelioration of the nervous symptoms, including increase of strength, and ultimately the secretions and excretions become natural. This result may be expected in most of the ailments or functional disorders which are of such common occurrence, provided proper treatment is carried out. In fact, the great majority of acute diseases terminate in complete recovery, though several affections of this class, when they do not prove fatal, are liable to leave behind them more or less serious deterioration of the general health, or even actual organic disease. In this class of cases, when recovery does ensue, it is usually only after a more or less prolonged period of convalescence. Chronic complaints, if they are of a structural nature, can not, in most instances, end in complete recovery, although to all appearances the patient may often be quite restored; but there are few diseases of a parenchymatous organ or of a serous structure that do not leave some trace behind, though it is often so inconsiderable as in no wise to interfere with the function of the part. Even in these cases, however, an actual cure may sometimes be effected, and that after a disease has had a prolonged duration. Instances of cure of diseases of a structural nature are illustrated by several chronic skin affections, syphilis, and chronic inflammation of mucous surfaces. Or it may happen that the patient recovers perfectly, only with the destruction of some structure which is not essential to life, such as the lymphatic glands.

"*Partial* or *incomplete recovery* is a very common mode of termination. This is observed in many cases of acute disease, where either the patient remains permanently in a state of general ill health, without any actual structural lesion being discoverable, or some positive organic affection has been established, of which phthisis remaining after acute pneumonia, or cardiac disease following acute rheumatism, afford proper illustrations. An attack of an acute malady may also serve to bring out some latent constitutional predisposition, or may leave the patient in such a condition that certain so-called constitutional maladies are readily originated from slight causes. Partial recovery, amounting often to a very marked improvement, may take place in many serious diseases of a chronic nature. This is illustrated by numerous cases of pulmonary consumption, in which disease great improvement is often observed, not only as regards the symptoms, but also in the local lesions—so much so that patients not uncommonly regard themselves as cured. Again, there are some complaints in which apparent recovery is brought about, but a tendency to recurrence remains, either without any obvious reason or from slight causes. Such affections are exemplified by ague, asthma, neuralgia, intestinal catarrh, bronchitis, and certain skin diseases. As instances of incomplete recovery may be also mentioned the cure of some prominent symptom or symptoms, while the disease which originates these phenomena continues unaltered. Thus it may be possible to get rid of ascites, which the patient regards as the disease from which he suffers, while cirrhosis of the liver, upon which the ascites depends, is a permanent condition; extensive dropsy, and other symptoms associated with cardiac diseases, may also be got rid of while the organic mischief still remains. Sudden lesions may terminate in partial recovery. For instance, a case in which a sudden hæmorrhage into the brain has occurred, attended by marked apoplectic and paralytic symptoms, not uncommonly improves remarkably in course of time, the clot being more or less absorbed. Some complaints which are usually sudden in their onset may apparently be recovered from completely, but sometimes set up conditions which ultimately lead to permanent disease. Thus the passage of a gall-stone or a renal calculus may excite such irritation as to cause an inflammatory process to be set up which may induce permanent mischief, such as closure of the bile-duct or the ureter in the several instances, and the effects may not be perceptible until a considerable interval has elapsed." Again, many of the ailments from which people suffer, as well as many chronic organic diseases not in themselves serious or giving rise to any important symptoms, and not implicating structures essential to life, may continue during the life of the individual, perhaps interfering but little or not at all with the health, or, at all events, not in any way contributing to the death of the patient when that event does happen. Such affections can hardly be said to have any termination.

Death, however, is, unfortunately, a frequent termination of disease. This event may take place suddenly or very rapidly from the occurrence of some serious lesion, or of grave functional disorder of an organ essential for carrying on the phenomena which constitute life. In other cases, death is the termination of a more or less acute illness, either affecting a person previously in the enjoyment of good health, or, what is not uncommon, being the consummation of a chronic malady which has existed for a longer or shorter period. In still other instances, death is a slow and chronic process, the patient gradually sinking, several causes and morbid conditions often ultimately contributing to the fatal event. The *modes* by which death in the patient may take place should now be considered, from a medical standpoint, somewhat more in detail. Physicians as well as unprofessional observers are aware that there are two modes of death: the one is gradual, the other more or less sudden.

The phenomena of gradual death vary a great deal in different diseases. It is a beneficient provision that the exit of our life should never be more terrible to the spectators than to the patient; that, before the struggle comes which is to separate the body and the soul, the one should

become insensible to impressions, and the other unconscious of suffering. Comparatively speaking, it is very unusual for the mind to remain unimpaired until death; the final struggle does not usually commence until coma has blunted the perceptions. "Then a cold and clammy sweat stands upon the skin, the respiration grows quicker and shorter, and seemingly anxious, but really automatic, efforts are made to expel the mucus which chokes up the lungs and begins to rattle in the throat; the artery at the wrist pulsates more rapidly, but with gradually decreasing regularity and strength, until it can no longer be felt; the hands roam about with an uncertain and tremulous movement, as if in search of something; and coldness seizes upon the fingers and toes and slowly advances toward the trunk. In maladies attended by much emaciation the state of the countenance is that called *hippocratic*, after the writer who first described it. It is attended by a total loss of the natural expression of the face; the skin is dry, shrunken, and pale, or of a greenish livid or leaden hue; the nose is cold, sharp, and has its extremity drawn to one side; the eyes are sunken, filmy, and half closed; the temples and cheeks hollow; the ears shriveled and retracted; and the lips and the lower jaw completely relaxed." The duration of these phenomena may not exceed two or three hours, or may last for one or two entire days. They are most frequently observed at the close of chronic diseases, but are occasionally met with in what is improperly called sudden death, *but which is only a sudden and short disease;* we allude to those cases of apoplexy in which death takes place within from ten to twenty-four hours after the commencement of the attack. The progress of the mortal symptoms is often in such cases precisely what has been described. Our knowledge of the mechanism of the act of death has been materially increased by the publication of Bichat's "Graphic Analysis," but we need only describe its principal varieties. There is a natural and there is an accidental death. The former occurs in old age, and is marked by the steady and gradual decay of the physical constitution as well as the decline of the so-called vital forces. "As man advances to the natural limit of his earthly existence, he loses, one after another, his means of intercourse with the external world. One by one all the avenues of sense are shut up, the ear grows dull, the eye dim, and smelling, tact, and taste are blunted; his mind, but feebly impressed with the objects and events around him, lies dormant, or is moved only by recollections of days long past; his tottering gait, his shriveled and horny skin, his yearning for the fireside and the genial warmth of the sun, show how languidly the great functions of the circulation are performed; by degrees his digestion becomes impaired, and then the decline proceeds more rapidly. Innervation, calorification, absorption, and secretion all become embarrassed as the capillary circulation languishes; sooner or later the function ceases, and, last of all, the heart dies." Death advances from the circumference to the center. Frequently, it is true, old persons are cut off by definite diseases, and then their mode of death differs in no essential respect from that met with at other periods of life.

On the other hand, there are many sudden deaths in which the starting-point and succession of the terminal phenomena of life can be distinctly traced. In these the cessation of function which constitutes death proceeds from the center to the circumference, commencing either at the heart, the brain, or the lungs. These three organs appear to be so directly and immediately essential to life as to have been called, figuratively, the "*tripod*" on which it rests; yet it must not be understood that they alone are thus essential, for, as in the case of old age and in that of many exhausting diseases, death evidently commences in the parenchyma of the organs. The nutritive function is then the first to cease, and that, doubtless, because the blood has lost its healthful qualities. In various acute diseases, too, it is impossible to analyze the phenomena of death so as to fix upon the organ in which it originates, and equally so to ascertain the cause of its occurrence. The following account of the modes of death is, therefore, to be received as the expression of what takes place in those cases only which are susceptible of analysis in o

sequence of all the organs retaining their integrity, except the one in which the fatal process takes its rise. It should, however, be borne in mind that, owing to the interdependence of all the vital functions, there is no such sharp line of demarkation in reality as we, for convenience' sake, make in theory between the various modes of death. Death commencing *at the heart* or by *syncope* is the most sudden form. The pulsations of this organ may be instantaneously stopped, and life extinguished like the light of a taper that is suddenly blown out. They may also decline more slowly and gradually, constituting death by asthenia. The former happens in certain diseases of the heart and its annexes, in wounds of the heart, in ruptures of its tissue, in mechanical obstruction to the passage of blood through its cavities and from debility of the organ, and from ruptures of an aneurismal sac and sudden dilatation of blood-vessels. In most of these cases the cause resides in the heart itself; but, apart from structural disease, its function is destroyed by some remote cause affecting its mechanism. Thus the heart may suddenly be made to cease through nervous influence. In other cases its function ceases because a sufficient quantity of blood no longer reaches the interior of the organ, as in profuse hæmorrhages, etc. The heart-action ceasing, the brain, in common with all the other organs, is deprived of its due supply of blood, and sensation and voluntary motion are at once suspended; the lungs cease their movements immediately afterward, and, the changes of the blood necessary even to the function of organic life failing to take place, those functions can be no longer performed. A gradual failure of the circulation, constituting death by asthenia, may be a natural termination of life, but it is also the mode of death after wasting and exhausting diseases, cold, inanition, etc. The vital powers in such cases fail gradually, while consciousness may be retained up to the last moment.

Death commencing *in the lungs*, or by *asphyxia*, or suffocation, is owing to some cause which prevents hæmatosis. Extensive hepatization or induration of the pulmonary parenchyma, tumefaction of the membrane lining the smaller bronchia, or the repletion of these tubes with mucus, false membranes, etc., mechanical obstructions of every kind to the entrance of air through the larynx or trachea, present examples of this cause. Owing to its influence, the venous blood, instead of acquiring in its circuit through the lungs the qualities of arterial blood, is returned to the left side of the heart, and thence distributed over the system, still loaded with the excrementitious matters which should have been exhaled or revived by contact with the air. Such a fluid is deleterious wherever it moves; in the brain it destroys voluntary motion, sense, and general sensibility, and induces coma; it impairs even the excited movements of the respiratory muscles, thus allowing the lungs, the pulmonary artery, and the right side of the heart to become gorged with blood, and the last-named organ, receiving through the coronary arteries so imperfect a stimulus, soon loses its power of contracting, and then death is complete. This is, perhaps, the most ordinary mode of death in acute diseases, but its progress is so gradual, and it becomes so involved with the declining power of the brain and heart, as well as with the failure of the nutritive function, that to assign to each of these causes its appropriate phenomena is, perhaps, impossible.

Death commencing *in the brain* or by *coma* is generally owing to compression by tumor of the meninges, by an effusion of serum, blood, or pus in or upon the brain, or by excessive congestion of the cerebral vessels. This latter may be from a great variety of causes, among which may be mentioned certain poisons, whether introduced from without—such as opium and narcotics generally—or arising within, owing to the non-elimination of waste products—as in uræmia—which not only induce congestion, but also affect the nerve-centers, both cerebral and spinal, and, in addition to producing unconsciousness or coma, bring on paralysis of the cardiac and respiratory centers. Loss of general and special sensation of voluntary motion and consciousness follows the action of any of these causes, but not always in the same order. Consciousness is, however, usually the first to fail, and then

the several senses cease to perceive impressions distinctly. Such, at least, is the case when death approaches slowly in consequence of serous effusion; but when more rapid in its onset—in apoplexy, for instance—all the functions of the brain are suddenly abolished; nevertheless, as was previously remarked, the patient may live internally for many hours, and even days, after the stroke, although he is to all appearances dead. This circumstance is readily explained by the physiological teaching of the present day. The movements of the organs of respiration and of the heart depend less upon the integrity of the brain than upon that of the medulla oblongata, for they are instantaneously arrested by pressure upon or injury to the latter, while, as we have seen, they may continue for a considerable period after extensive disorganization of the cerebral substance. Whether, in apoplexy and kindred affections, the pressure upon the brain extends ultimately to the medulla by means of serous effusion, or whether there is an indirect functional dependence of the latter organ upon the former, is, perhaps, not precisely determined. Certain it is, however, that, in death commencing with the brain, actual dissolution does not take place until the other two triumvirate rulers of life have lost their powers. Respiration first becomes embarrassed through paralysis of the respiratory muscles. Asphyxia commences, and, as it proceeds, the heart becomes gorged, and at last ceases to pulsate. Thus it will be observed that, however the act of death may commence, it has one uniform termination—*cessation of the heart's movements.* In death from paralysis of the vital nerve-centers, or coma, the individual lies unconscious, reflex action becomes abolished, and the breathing becomes stertorous and ultimately ceases, death occurring quietly or in convulsions. In death from coma, in addition to the usual phenomena of asphyxia, there is, as a rule, more or less marked congestion of the cerebral and spinal centers, being of sufficient degree about the medulla and pons to cause paralysis of respiration and circulation.

Symptoms and Signs of Disease.

When disease affects any of the functions or structures of the body, it produces certain altered actions or changes which, when observed during life, become evidence of its presence and often of its nature, and which are then called symptoms and signs of disease, and, in a more general sense, they comprise "any past or present circumstances afforded by the examination of a patient or of matters concerning him from which a conclusion may be drawn regarding the nature and seat of existing disease."

The terms *symptom* and *sign* are often used synonymously, though the derivations of the words are by no means the same. The word *symptom* is of Greek origin, and means simply a *coincidence*—that is to say, it coincides with the presence of certain phenomena. The term *sign*, derived from the Latin (*signum*), is more distinctive, and seems more directly to point to some special or peculiar condition. Recently, however, an attempt has been made to give a more special meaning to these terms. Symptom, more especially if it be characterized by the prefix *vital* or *rational*, is intended to refer to the modifications of functions, or to such *subjective* phenomena as we can learn from the patient's account of his feelings. On the other hand, the term *sign*, especially with the prefix *physical*, indicates those morbid changes which are *objective*, or which require recognition by the senses of the physician, assisted by other appliances—*a special cultivation of touch, sight, or hearing being essential* in order that they may be accurately determined.

Rational symptoms of disease form the chief means of diagnosis, except in conditions of the respiratory organs, abdominal viscera, and the circulatory and genito-urinary system, in which physical signs are also important.

Among the more prominent of the innumerable symptoms of disease may be mentioned: (1) Abnormal attitudes and physiognomy; (2) variations in the pulse and temperature; (3) pain in all its forms and situations; (4) cough and expectoration in all its varieties; (5) nausea and vomiting; (6) chill; (7) dyspnœa; (8) diarrhœa; (9) jaundice; (10) coma; (11) ascites

(12) hæmorrhage from the different organs; (13) aphonia; (14) constipation; (15) paralysis in all its forms; and (16) abnormal conditions of urine.

Physical signs are of value in determining during life the anatomical changes taking place in tissues and organs. In order to detect them, the following methods are employed: (1) *Inspection;* (2) *palpation;* (3) *percussion;* (4) *auscultation;* and (5) *mensuration.*

It is by the investigation of these symptoms, and from conclusions derived from physical signs by the means indicated, that we are mainly enabled to form our diagnosis. "The more accurate and complete our knowledge of the functions of the body and of its component parts, and the more capable we are of interpreting with all the completeness possible the changes produced by disease, the more accurate will be our diagnosis as to its presence and its nature." The significance of these symptoms and physical signs and how such phenomena may be best observed, will now be discussed in the order in which they have been enumerated.

Symptoms relating to Abnormal Attitudes of Patients.—It should be stated at the onset that some persons often present peculiarities with reference to attitude which are of no practical significance, as they may be the result of natural differences in individuals or of habit; hence any peculiarities natural to the individual in this respect should first be ascertained before interpreting them with diagnostic importance.

A child can not sit erect until the fourth or fifth month, and can not raise its head from the pillow until the second month of age. A healthy person in bed usually lies upon the right or the left side, with the limbs semi-flexed, the head bent somewhat forward, and the whole body in an unconstrained and easy posture. The nearer the attitude of the sick person corresponds to this, the less grave in general is his disease. The following are the most striking examples of postures, spontaneously adopted by patients, which are likely to afford the most useful information in the investigation of disease: The *supine position*, or dorsal decubitus, is that which belongs to nearly every disease of debility; it is the one which gives the greatest support to all the limbs and leaves the freest play to the lungs and heart, and is, therefore, instinctively assumed when exhaustion is extreme. It is also met with when the pain attending motion is so intense as to force the patient to remain perfectly still, as in acute peritonitis and in general articular rheumatism, or when both cavities of the chest are affected with pleuritis or pneumonia. Its different degrees indicate those of exhaustion. The patient may simply lie motionless without the power of turning upon his side, or he may have his knees drawn up, or, in spite of all efforts of the attendants, he will slide down toward the foot of the bed, or his arms may be thrown to a distance from the body and the lower limbs stretched apart; and if he lies thus, and still slips downward in bed, with the head thrown far backward, the neck prominent, or the chin resting upon the chest, it may be concluded that he has not long to live. Cases exceptional to so unfavorable an interpretation may occur in paraplegia, in which the condition of the lower extremities disposes the patient to lie upon his back, and prevents him from resisting the force of gravity which carries his trunk downward. *An inability to lie down* constitutes a prominent feature in certain forms of cardiac and pulmonary disease, in consequence of interference with the respiratory function, so that the patient is obliged to sit up, or lie propped up in bed, or sometimes even to sit up in a chair, to assume the erect posture, or to bend forward. Again, when anything is pressing upon the trachea—such as aneurism, causing obstructive dyspnœa—the patient may instinctively lean forward to take off the pressure as much as possible. In *acute peritonitis* the patient usually lies upon *the back, with knees well drawn up* and bent in order to relax the abdominal muscles. In *cerebral meningitis* the patient often lies in a curled-up position, all the limbs being bent *toward the body.* In *spinal meningitis* the head may be *involuntarily drawn backward.* In cataleptic conditions any posture that is assumed is *retained for an indefinite length of time.* In general, patients can not lie upon the left side when the heart is enlarged or violent in its action.

Lying upon the abdomen and turning from prone to supine posture is symptomatic of colic and the passage of gall-stones. In other spasmodic, painful attacks in the abdominal region, patients frequently bend forward in a doubled-up position, pressing upon the bowels. In irritative disorders of the liver with enlargement the patient lies upon the right side. In compression and softening of the brain and in the commencement of dementia the patient often obstinately maintains the same position, and, if disturbed, will soon relapse into it. On the other hand, great agitation and restlessness characterize certain other diseases. When a patient tosses about in bed, or is perpetually rising up or lying down, or otherwise showing great inquietude, it indicates the presence or imminence of a severe febrile attack, and is a state of things very commonly preceding the appearance of the eruption of exanthematous fevers: occurring in the course of an acute or chronic disorder, it must be viewed with alarm—denoting serious complications or an aggravation of the original disease. In hemiplegia there is a constant tendency to turn upon the affected side. In the forming stage of unilateral pneumonia or pleuritis, the suffering from the "stitch" in the side is increased when pressed beneath the weight of the patient's body. So long as the pain lasts, to avoid aggravating it, the patient lies upon the healthy side; but after a day or two, when the severity of the pain gives way to dyspnœa, as the hepatization of the lung proceeds or pleural effusion takes place, he then instinctively takes the best means in his power of giving a large expansion to the healthy lung by assuming the dorsal decubitus, or by lying upon the *affected side*. In nervous disease, posture may be of value in diagnosis by revealing paralysis of different parts; and, lastly, the position voluntarily assumed by a limb may give important information as to local disease likely to influence it in this respect, such as those of the joints, and, in fact, the whole body may be distorted as well as the limbs in connection with diseases of the articulations.

Symptoms relating to Physiognomy.—Practically, it is no small part of the accomplishment of a skillful physician to be able to recognize readily in any sick person the outward signs of expression, etc., which may be characteristic of his malady. Certain symptoms connected with the expression of the face are common to several disorders; thus we have that of *anxiety* in organic disease of the heart, acute disorders of the abdominal viscera, and spasmodic affections, as asthma, angina pectoris, etc. It is *blank and still* in paralysis; that of immobility in debility, loss of consciousness, and general tonic spasm. It is *indifferent, look partially fixed, eyes bright*, in chronic disorders unattended with pain, and in the latent stages of fever. It is that of *rage* in hydrophobia, acute mania, and inflammations of the brain. It is *sad and desponding* in hypochondriasis. It is that of *terror or great fear* in delirium tremens, hæmorrhage, or mania. And it is *bashful and downcast* in impotence. The *pupil of the eye is contracted* in inflammation of the brain or retina, narcotism by opium or calabar-bean, and in the early stages of hydrocephalus; it is *dilated* in apoplexy, advanced hydrocephalus, amaurosis, cataract, narcotism by belladonna or stramonium, and from effusion or pressure on the brain; and it is *immovable*, or there is a difference between the two pupils under a strong light, in ophthalmic or cerebral disease. The *eyes* are sunken in atrophy of parts behind the eyeball, as in phthisis and wasting diseases; if only one eye is in this condition, it denotes brain disease or paralysis of the optic nerve. The *luster* of the eye is *lessened* in acute depressing diseases, infectious and pestilential maladies, exhaustion, and in nervous debility; it is *brightened* during the progress of phthisis, and in inflammation, displacement, or irritation of the ovaries. But, aside from all these, there are certain other traits of the countenance, either singly or combined, which have diagnostic significance. They constitute severally the physiognomical expressions of particular morbid conditions belonging to different diseases. In other words, a characteristic *facies* enters into the diagnosis of some diseases. In addition to the yellowness characteristic of jaundice, the bronzed coloration in the so-called Addison's disease, strabis-

mus and variations of the pupil in nervous affections, dilatation of the nostrils in diseases affecting respiration, and modification of expression in certain forms of paralysis, the following are mentioned by Prof. Flint as constituting the more notable of the different facies:

The Facies of Anæmia.—"Paleness of the face, and especially of the prolabia, is indicative of paucity of red globules in the blood. This pathological condition is incident to a great variety of diseases. If the face do not show emaciation and the patient have not an acute disease, the paleness is evidence that the anæmic condition is the result of hæmorrhage, defective alimentation, or some other cause not involving any grave, co-existing affection. A greenish hue in connection with pallor is the etymological sense of the term chlorosis.

The Cyanotic Facies.—"Lividity or blueness of the face, more especially of the prolabia, is the characteristic feature of the congenital affection which has been called *morbus cæruleus*—an affection involving malformations of the heart, usually connected with obstruction at the orifice of the pulmonary artery. The lividity is due chiefly to the congestion of the venous radicles caused by an obstacle to the circulation in the right cardiac cavities. The presence in the systemic arteries of blood imperfectly oxygenated doubtless contributes to the lividity. The cyanotic aspect in diseases of the heart represents either lesions at the tricuspid orifice, or, much more frequently, dilatation of the right ventricle and auricle resulting from mitral lesions. Persistent obstruction in the course of the pulmonary circulation, as in cases of emphysema, may lead to dilatation of the right side of the heart and consequent cyanosis. Lividity of the face in conjunction with œdema and dyspnœa is highly diagnostic of cardiac disease. The lividity which is often marked in different pulmonary affections—namely, pleurisy with large effusion, or empyema, hydrothorax, pneumonia, acute tuberculosis, and bronchitis affecting the small bronchial tubes—denotes, together with deficient oxygenation of the blood, an over-accumulation in the right ventricle irrespective of any cardiac lesions, and it may foreshadow death from paralysis of the heart, due to distention. The lividity in cases of epidemic cholera is attributable in a great measure to stagnation in the venous radicles of the circulation in consequence of the blood-changes in this disease: hence the significance of the term cyanotic cholera. A tumor pressing upon the descending vena cava may cause an intensely cyanotic facies. It occurs in paroxysms of laryngeal spasm. It is sometimes marked in the cold stage of intermittent fever.

The Facies of Renal Disease.—"In some cases of acute albuminuria, and of chronic parenchymatous nephritis—the large white kidney of Bright—puffiness of the face from œdema, with notable pallor, renders the aspect highly diagnostic.

The Malarial Facies.—"Pallor of the face, sallowness, and slight puffiness, if renal disease be excluded, point to malarial disease.

The Facies of Carcinoma.—"Notable anæmia, a waxy or straw-colored complexion, and more or less emaciation, in combination, render the aspect marked in some cases of malignant disease. In a patient over forty years of age this aspect has considerable diagnostic import, although it is by no means always present when malignant disease exists.

The Typhoid Facies.—"In the middle and latter periods of typhoid fever the countenance is often dull, besotted, and expressionless. This facies may be present in the typhoid state which is incident to disease other than typhoid fever, as, for instance, pneumonia.

The Facies of Acute Peritonitis.—"The upper lip raised so as to expose the front teeth gives an aspect which characterizes, in a certain proportion of cases, acute peritonitis. It is often wanting, but, when present, is strongly diagnostic.

The Facies of Acute Pneumonia and Hectic Fever.—"Circumscribed redness of one or both of the cheeks, with abruptly defined borders, is diagnostic [of a]cute pneumonia. If it be observed in a case of chronic pulmonary [dis]ease, it denotes the so-called hectic fever, and is a sign of phthisis.

The Facies of Exophthalmic Goitre.—" Projection of the eyeballs, giving the face a remarkably staring and sometimes ferocious expression, conjoined with enlargement of the thyroid bodies and frequency of the pulse, is distinctive of the affection known as exophthalmic goitre, Gravis's disease, and Basedow's disease.

The Choleraic Facies.—" In the collapsed stage of cholera the face is contracted, sometimes wrinkled; the cheeks are hollow, the eyes are sunken, the skin is livid, and the expression denotes indifference. This combination of traits is quite distinctive. They are, to a certain extent, combined in the state of collapse which occurs in some cases of pernicious intermittent fever, and in other pathological connections.

The Hippocratic Facies.—" The most dangerous of all the facies is that condition of the features known by the above name, for it denotes the moribund state, and was named after Hippocrates, who so graphically described it (more than two thousand years ago) in the following terms: 'The skin is pale, with a leaden or livid hue; the eyes are sunken, the eyelids separated, and the cornea loses its transparency; the nose is sharp or pinched, and cold; the ears are contracted and their lobes are shriveled; the brows are knitted, the temples are hollow, and the lower jaw drops. If the patient has been excessively fatigued, or has suffered from diarrhœa or starvation, this state of the countenance is less ominous; but, arising from any other cause, and so continuing without a change for twenty-four hours, a speedy death may be predicted.' It would scarcely be possible to render this picture more perfect, or to add anything to the caution which is given in regard to interpreting it. The *facies Hippocratica* may be seen in many cases of great and rapid exhaustion without its betokening a fatal issue; but if, within twenty-four hours, reaction does not take place (and it rarely does so in diseases which have extended beyond a week), there is not the least ground on which to build a hope of cure."

Symptoms relating to the Tongue.—" In connection with the symptoms of disease from certain expressions of countenance, the size, shape, and movement of the tongue, its color and the character of its coatings, have from time immemorial been considered as furnishing special information respecting the nature, seat, and progress of different diseases. Many of the notions which formerly prevailed, and which are still to some extent entertained, with regard to the significance of the varied appearances pertaining to the volume of the organ, its form, and coatings, are without foundation. Custom has rendered a close inspection of the tongue so much a matter of course, that patients would be likely to impute to the physician negligence were it to be omitted. In the popular mind there is a certain mystery connected with the examination of the tongue, which is kept up by the minuteness with which the organ is examined by means of the touch, as well as the sight, by some practitioners, who, taking advantage of this, have made its inspection a mere occasion for mysterious looks and oracular remarks. It may be said that undue importance is likely to be attached to the varied appearances which this organ presents in proportion to a lack of ability to appreciate other and more reliable symptomatic phenomena. Nevertheless, useful information may frequently be obtained by inspecting the tongue with reference to the points of observation now to be noticed.

" The tongue varies in size and form in different diseases. There is considerable variation in this respect in healthy persons. It may be compact and triangular, or broad and flabby. These appearances have no special significance, except that the tongue may be *enlarged* in glossitis and from cancer, and in the former to such an extent that it projects beyond the lips. Formerly this condition sometimes resulted from excessive salivation. The tongue is also swollen in sore throat, and may be large and flabby in many bad cases of dyspepsia, showing upon its edges indentations made by pressure of the teeth. These indentations may occur, whether the tongue is swollen or not, from remaining in contact with the teeth for a considerable time. In health, during wakeful hours, the tongue is frequently moved, not

remaining, except momentarily, in the same place. The indentations due to diminished movements denote mental hebetude. The tongue occasionally presents fissures or cracks in the course of fevers, and these sometimes continue into convalescence. Cicatrices are observed in persons subject to epilepsy, as a result of wounds inflicted by the teeth during the paroxysms. These may be useful in determining that paroxysms which a patient has experienced were epileptic in character. The entire volume of the tongue may be *diminished* when there is great general emaciation; if the size diminish very much, and is at the same time retracted and pointed, even in acute diseases, the prognosis is bad. Prolonged hemiplegia frequently induces atrophy of one side of this organ.

"*Involuntary movements* of the tongue denote morbid conditions of the nervous system. Tremulousness is a symptom of alcoholism, often preceding tremor of the hands and the mental manifestations of delirium tremens. It represents, in cases of typhus and typhoid fever, and in the typhoid state incident to various diseases, notable muscular weakness. Occurring early in the fevers mentioned, it foreshadows gravity of disease. It is among the toxical effects of lead and mercury.

"Symptoms relating to the *voluntary movements* of the tongue are significant of mental conditions. In typhus and typhoid fever, and in the *typhoid state* incident to other affections, the tongue is often protruded slowly and with difficulty, showing diminished power of the will over the voluntary muscles. Delay in protruding it without any real difficulty shows a lack of apprehension or a morbid sluggishness of mind. In some cases of fever and of cerebral diseases a request to protrude the tongue has to be made repeatedly before an effort is made, owing to weakness of the mental faculties; and, having been protruded, it may not be withdrawn until a request is made and, perhaps, repeated. Owing to mental hebetude, the patient forgets that it is protruded. It is a curious fact that patients will frequently protrude the tongue when they can not be made to do aught else, owing to the state of the mental faculties.

"Paralysis of the genio-hyoglossus muscle on one side causes a lateral deflection of the tongue, the apex pointing to the paralyzed side. This is generally observed in cases of hemiplegia, and denotes morbid conditions within the opposite side of the skull; also in some cases of facial paralysis, the upper and lower extremities not being affected. In the latter case, it is evident that the paralysis is centric, and not peripheral. In the affection known as glosso-labial or bulbar paralysis, the ability to protrude the tongue is impaired or lost. The tongue often *appears* to deviate laterally in old persons, owing to loss of teeth on one side.

"*Pallor* of the tongue and of the mucous membrane in other situations within the mouth denotes impoverished blood, or anæmia. A livid aspect is evidence of cyanosis, the lividity being more or less marked on the prolabia and face. An abnormal redness of the dorsal surface is not uncommon in the course of fevers and acute inflammations, especially after a coating has been thrown off; and, if the redness continues, another coating is apt to take place. Redness and an excoriated appearance, with soreness, characterize the anæmia induced by lactation, otherwise called stomatitis materna, or nursing sore-mouth. A similar appearance occurs in some cases of phthisis and in other affections attended by defective nutrition. There is no ground for the doctrine that notable redness of the tongue is symptomatic of inflammation of the lining membrane of the stomach or intestines. It is often wanting, if not generally so, in cases of gastritis, enteritis, and dysentery, and it is present when neither of these affections exist.

"When the redness of the tongue is not uniform, but shows itself in disseminated points, which are the turgid papillæ projecting through a white coating of mucus, presenting the appearance which has been compared to that of a ripening strawberry, it is almost pathognomonic of scarlet fever, but by no means present in all cases. The terms *furred* and *coated*, applied to the tongue, express a variety of appearances. It is said to be *furred* [illegible]

frosted when either the papillæ are elongated by opaque epithelium, or the surface is white from a thin epithelial covering. The whole or only a part of the dorsal surface may be furred, and, if limited, it is usually at the base, extending more or less toward the apex. A furred tongue has no special significance. It is habitual with some persons who consider themselves well. Usually, however, it denotes some disorder of health. It occurs, as a rule, whenever febrile movement from any cause exists. Persons who suffer from disordered digestion are apt to have a furred tongue. A uniform white and thin covering, extending over the whole dorsal surface, giving an appearance as if the surface were chalked or covered with white paint, is often observed in patients with intermittent fever, and is sometimes called a *malarial tongue.* This is somewhat characteristic.

"The tongue is said to be *coated* when the surface is more or less covered with a deposit not very thin, but varying in thickness in different cases. The coatings consist of epithelium, concrete mucus, dust inhaled with the breath, sometimes blood, particles of food, matters vomited (the latter, perhaps, containing bile), and parasitical growths."

A coated tongue occurs in a host of diseases. It is evidence that the system is disordered, but it does not point either to the seat or the nature of the malady. It may be stated, upon the authority of Flint and other careful clinical observers, that there is *no ground for the opinion that different appearances of the coating represent certain conditions of the gastric or intestinal mucous membrane.* "Clinical observation shows that the appearances denote disturbances of the system rather than any particular local affections. The coatings vary in color. They are sometimes yellow, and are then said to be bilious; but the yellowness is not due to bile, even if cholæmia exists, and certainly not if no other evidence of jaundice exists. A bitter taste is not evidence of the presence of bile. There is no established connection between any condition of the tongue and disorder of the liver. A variation in the character of the coatings, from a yellowish hue to a brown or black appearance, is indicative of a lowered state of the vital powers, arising from blood contamination as the result of defective excretion in general, and not necessarily that of the liver alone. The coatings are sometimes dark and black in typhus and typhoid fever, and when the typhoid state is manifested in connection with any disease. The coatings sometimes become dark, and even black, either from chemical changes or a little escape of blood. Contact with certain medicines, especially preparations of iron, alimentary substances and matters which are vomited, may produce this effect. Coatings are sometimes shed and reproduced once or repeatedly during the course of fevers and in other diseases. If, when a coating be shed, the surface of the tongue be abnormally red, another coating is likely to follow. In general, shedding or thinning of the coating, and a normal color of the surface, are favorable symptoms, denoting progress toward convalescence. This is especially true in cases of fever. The improvement generally begins at the sides and tip of the tongue, extending gradually over the surface. When, in the course of fevers or other diseases in which the whole surface has been more or less heavily coated, the margins become clean, moist, and of a natural color, and the extent of the coating lessens day after day, the probability of a speedy convalescence may be predicted. The tongue is aphthous in the thrush of infants, last stage of phthisis, and visceral diseases tending toward a fatal termination. Dryness of the tongue is a symptom in a variety of diseases—namely, in the essential fevers and in symptomatic fever, in diabetes mellitus and insipidus, and in functional disorders of digestion. The dryness varies in degree in different cases, and may be a source of discomfort, or the patient may be unconscious of it. The dorsal surface sometimes becomes so dry and resisting that to the touch it has a horny hardness. This occurs in the typhoid condition of disease. It denotes deficiency of mucus and the salivary fluids, together with deficient movements in consequence of blunted sensation and mental hebetude. Persistent somnolency, the mouth being open, contributes to it, the surface being desiccated by the current of air p

ing over it. Dryness from desiccation is an effect of the increased frequency of the respiratory acts in pulmonary diseases involving dyspnœa." When the tongue presents a dry, rough, hard, and dark appearance after having been furred and loaded, it indicates a dangerous prostration, contamination of the blood with suppression of secretions. But, in conclusion, it should be stated that not very infrequently, in different acute and chronic affections, during the whole course of the disease, the tongue has presented a normal appearance.

Symptoms relating to the Pulse.—Variation in the pulse affords information with regard to important pathological conditions; but, before we present the abnormal characters of the pulse, certain influences which affect its frequency and force within the limits of health ought to be well understood. The pulse is liable to vary within the limits of health from the diversity of age, sex, stature, muscular exertion, condition of the mind, state of the digestive process, and period of the day.

The following table is given by Carpenter as an approximation to the average frequency of the pulse per minute at different ages:

In the fœtus	140 to 150
Newly born infant	130 to 140
During the first year	115 to 130
During the second year	100 to 115
During the third year	95 to 105
From the seventh to the fourteenth year	85 to 90
From the fourteenth to the twenty-first year	75 to 85
From the twenty-first to the sixtieth year	70 to 75
In old age	75 to 80

The pulse of the adult female usually exceeds that of the adult male of the same age by ten to fourteen beats a minute. The pulse is less frequent as the stature is greater—about four beats per minute for half a foot in height. It is well known that muscular exertion, as rapid walking, climbing stairways, etc., increases the frequency of the pulse.

The effects of posture may be expressed in the following table:

Average beats per minute.	Standing.	Sitting.	Lying.
Healthy males	81	71	66
Healthy females	91	84	79

According to this, the difference between standing and lying in the former is one fifth, in the latter one eighth. When the change is effected by muscular effort, the variation is greater, accounting for many cases of sudden death in persons with disease of the heart, or in very weak conditions, on quickly assuming an erect position. Mental excitement, the digestive process, alcoholic drinks, and attitude accelerate the pulse and affect its force. And, as a general rule, though with numerous exceptions, it is more frequent in the morning than in the evening, and in the sanguine than in the lymphatic temperaments. The pulse is slower during sleep, and from the effect of rest, diet, cold, venesection, and the action of many drugs, especially tartar emetic, digitalis, aconite, and veratrum viride.

The pulse may be counted in any artery, but more convenient in the radial at the wrist. The most important factors in determining the characters of the pulse are the action of the left ventricle of the heart, and the facility with which the blood passes from the arterial to the venous system; in other words, the blood-pressure or arterial tension. Other circumstances, however, affect the pulse materially; namely, the quantity of blood, the flexibility or rigidity of the arterial coats, and the quantity of soft tissues around the vessel. The abnormal characters of the pulse may be arranged as follows: Increased frequency, diminished frequency, quickness and slowness, [illegible]ness and softness, fullness and smallness, strength and weakness, an[illegible]

irregularity. The *clinical import* of these variations will now be considered in accordance with the views of Prof. Flint, and in the order mentioned.

Increased Frequency of the Pulse.—"Instances of a frequency considerably above the average as a normal peculiarity are, perhaps, less numerous than the instances of notable infrequency; but a pulse of from 90 to 100 in healthy adults is not extremely uncommon. The frequency of the pulse is more or less increased, with rare exceptions, whenever fever exists. This holds true alike in the essential fevers and in the febrile movement incident to acute inflammations. In these connections increased frequency of the pulse is associated with an increase of the temperature of the body as shown by the thermometer. The frequency of the pulse is, in a measure, a criterion of the intensity of the fever, although less reliable than the increase of temperature. Its significance has relation especially to the forces carrying on the circulation, or, as is commonly said, the vital powers. If an abnormal frequency be more than moderate, it denotes weakness of the heart's action, and the weakness is great in proportion as the pulse is frequent. In fevers and acute inflammations, assuming the patient to be an adult and the normal pulse to be near the average of health, a frequency of 100 or 110 per minute is not necessarily associated with notable weakness of the heart's action; but a pulse of 120 denotes considerable, and beyond this, if persistent, great weakness. The danger of dying by asthenia may be estimated by the frequency of the pulse. With respect to prognosis, the variations in frequency of the pulse from day to day furnish important information, and valuable indications for treatment are derived therefrom. Prior to the employment of the thermometer in clinical medicine, physicians relied chiefly upon the frequency, together with other characters, of the pulse in judging of the favorable or the unfavorable course of fevers and acute inflammations. From the constancy of more or less increased frequency of the pulse in these diseases, it follows that they may be excluded when the pulse is not more frequent than in health. As a rule, with some exceptions, this statement is correct.

"In chronic inflammations the frequency of the pulse is a guide in judging of the degree of constitutional disturbance, or the tolerance of them by the system. For example, in pneumonic phthisis—other things being equal—the disease may be said to be telling upon the powers of life in proportion as the pulse is persistently frequent. This symptom has an important bearing upon the prognosis and on the propriety of sending patients far away from home; the same is true of other chronic affections. In nervous affections the pulse often becomes notably frequent, but the frequency is but temporary. It is in many instances due to mental excitement at the time when the pulse is counted. A transient frequency, however great, is not evidence of fever, inflammation, or any grave affection. It is not uncommon for the action of the heart to be excited by the visit of the physician. It is a good rule, therefore, if the pulse be frequent at first, to count it afterward or repeatedly before the visit ends. A comparison, after an interval of a few minutes, sometimes shows a striking contrast. In many of the cases of neuralgia, simulating, as regards pain, inflammation, such as intercostal neuralgia and enteralgia, the pulse retains its normal frequency—a fact which, in conjunction with the temperature, establishes the diagnosis of a neuralgic affection. It is customary to note the frequency of the pulse with exactness by the watch. The advantage of counting is considerable, for the reason that exact knowledge of the frequency is often too important for reliance to be placed on guessing. Especially during the course of acute disease it is desirable to determine with precision the variations from day to day with reference to prognosis and treatment. The foregoing facts in regard to abnormal frequency of the pulse are derived from clinical observation. Why the pulse is more or less frequent in fevers and acute inflammations has been partly explained by the researches of Marey, who has shown that the frequency has relation to arterial tension. Lessening the tension increases the frequency, and *vice versa;* but the irritating effects of contaminated blood upon the nerve-centers, perhaps, is an important factor in augmenting the hea-

action, and the increased temperature may stimulate the pulse beyond its normal frequency, although, from the influence of antagonistic causes, there is often a considerable difference between the degree of frequency and the amount of increased temperature. Notable increase in the frequency of the pulse without fever is a symptom of exophthalmic goitre. In this affection the pulse may be from 110 to 120 per minute, and this frequency is tolerated for months and years. A fair inference is that, in acute diseases, the danger to life is not occasioned by the frequent action of the heart *per se*, but by *conditions which it represents.*

Diminished Frequency of the Pulse.—" An abnormal infrequency in cerebral affections denotes compression of the brain from congestion, the presence of serous effusion, exudation of lymph, or extravasated blood. It occurs at the time of convalescence in fevers and some inflammations, such as pneumonia, and, under these circumstances, has not an unfavorable significance. It is a feature of a rare variety of functional disorder of the heart. It has diagnostic significance in cases of hepatic colic. It occurs in cases of cholæmia, or jaundice. It may be a normal peculiarity. Some persons in health have a pulse of 40, or even less. In these persons a pulse of the average frequency denotes disease; hence the importance of knowing the peculiarity of patients in this respect.

Quickness and Slowness of the Pulse.—" The frequency of the pulse represents, as a rule, the number of the ventricular systoles. The term *quick* is often applied to the pulse in a sense synonymous with the term *frequent*. This is an incorrect application. Quickness denotes the sensation which the arterial pulsations give to the finger—a sensation of abruptness or celerity. A pulse may be more or less frequent without being quick, and the latter may be marked when the frequency is normal. The sphygmographic delineation of quickness is a vertical line of ascent. A quick pulse implies, doubtless, a corresponding quickness of ventricular contractions. But it represents especially weakness of arterial tension, so that sometimes a reduplication of the pulse is perceptible to the touch, constituting what is known as the double or dicrotic pulse, in which there are two perceptible pulsations of the artery for every contraction of the heart. Of these two pulsations, only the first is caused by the impulse of the heart; the second is due to oscillation of the blood in the relaxed arterial tube. This is common in increased temperature, which diminishes the resistance of the arterial walls to the heart's impulse. In a clinical view, the practical point is not to regard a quick pulse with an amplitude which may render it "bounding," as representing the force of the heart's action. The tactile sensation is in this respect deceptive. While it is evidence of a certain amount of ventricular force, it represents more especially feeble arterial resistance, or, in other words, relaxation of the small arteries, in consequence of which the blood passes with facility into the venous system. Quickness and the sensation of force are the characters of the pulse in the essential fevers, and in paroxysms of hectic fever. The pulse is often, however, quick in non-febrile affections, and the characters just named are strongly marked in cases of free aortic regurgitation.

" The term *slowness* applied to the pulse should be used in a sense antithetical to quickness, denoting not infrequency, but a slow, as contrasted with a quick, impulsion against the fingers. If this character be marked, the artery seems to pulsate sluggishly. This sensation, disconnected from other characters, may lead to an under-estimate of the force of the heart's action. The "sphygmographic" character is the comparative obliquity of the line of ascent. The significance of slowness is the resistance afforded by arterial tension. By hæmorrhage, or the abstraction of blood, a slow pulse may be changed to one which is quick and giving the sensation of increase of force, the change being due to diminished arterial tension.

Hardness and Softness of the Pulse.—" A hard pulse offers an abnormal resistance to the pressure of the fingers. When the resistance is notably great the pulse is said to be incompressible. The hardness is in proportion to the power of the heart's action and the degree of arterial tension. To determ-

the relative agency of these two factors is not easy. The auscultatory evidence of the power of ventricular systole is the intensity, length, or duration of the first sound of the heart over the situation of its apex. And the degree of arterial tension is shown by the line of descent in the form of the pulse as registered by the sphygmograph. The graphic traits of a hard, slow pulse are small amplitude, an oblique line of ascent, and an outward curve of the line of descent, the dicrotic wave being slight or wanting. By venesection, or the use of remedies which lessen the degree of arterial tension, the pulse is rendered quick, and this, with an increase of amplitude, gives a sensation of greater force, the frequency being also increased. So far as the touch is concerned, however, the most reliable criterion of the actual force or strength of the pulse is the sense of resistance or incompressibility. The hard pulse is commonly met with in membranous inflammations and rheumatism, and often during the paroxysms of convulsive disorders. So long as the pulse retains its hardness, the activity of the inflammation is unabated.

"The pulse is *soft* when the sense of resistance to the fingers is slight. Softness is the opposite of hardness, and represents feebleness of ventricular contraction as well as lessened arterial tension. A soft pulse which is also quick and has considerable amplitude may give a delusive sensation of force. The sensation may be considered as delusive whenever the pulse is found to be notably compressible. An extreme degree of softness gives a sensation as of air, not liquid, circulated in the vessel; hence the expression "gaseous pulse." The *soft* pulse exists in petechial, typhus, and other malignant fevers; it is full and soft, and yet the slightest pressure arrests it. The pulse after exhausting discharges is soft, but is usually small and feeble at the same time.

Fullness and Smallness of the Pulse.—"The pulse is said to be full when the size of the artery is large, giving the sensation of being filled or distended with blood. This character denotes vascular repletion. Other and opposite characters may be therewith conjoined. A full pulse may be more or less frequent, quick or slow, hard or soft. Disconnected from other characters, fullness has no special diagnostic or pathological significance. It has no distinct graphic expression. As evidence of plethora, or that the quantity of the blood is abundant, it may be taken into account in judging of the propriety of abstracting blood or for other measures of depletion.

"The pulse is abnormally *small* when the size of the artery seems to be diminished. Within a certain limit, smallness of the pulse does not imply deficient power of the heart's action. What is known as the "wiry pulse" is small, but not wanting in force. This is observed in cases of acute peritonitis. Smallness of the pulse often depends upon narrowing of one of the orifices of the left side of the heart; it should, therefore, always suggest the propriety of examining the heart. Before its connection with this lesion was known, the small pulse was regarded as a sure sign of debility, and sometimes led to a plan of treatment opposite to what was required. The pulse is small and without hardness in chlorosis, anæmia, and during violent paroxysms of pain. Under these circumstances the artery may be so reduced in size as to feel like a mere thread beneath the finger. This is the *filiform* pulse. The thready pulse, united with quickness, precedes its extinction when death takes place by slow asthenia. Hence, beyond a certain limit, a small pulse represents weakness of the ventricular contractions. The pulse is both small and feeble in cases of disease characterized by debility of the circulation induced by excessive discharges of any kind—whenever, in other words, the amount of blood in the vessels has been greatly reduced. It acquires these characters also when the blood has been diverted from the ordinary channels of circulation and accumulates internally, as in the cold stage of febrile disease. When it occurs in the course of disease, it is an unfavorable sign, unless it speedily assumes more natural characters. A pulse gradually becoming smaller and weaker in chronic diseases is evidence of their progressive inroad on assimilation and the powers of life." These characters are rapidly induced in diseases which occasion the state of collapse.

of which epidemic cholera is a striking illustration. The size of the pulse, in conjunction with that of force, thus enters into the prognosis in certain chronic and acute affections. The pulse of an adult above 150 in a minute and of a filiform character is one of the most unequivocal signs of a fatal issue. The pulse, however, becomes exceedingly small, and even extinct, transiently, in connection with profuse hæmorrhage and nervous disorders which tend to produce syncope.

Strength and Weakness of the Pulse.—The modifications belonging under this head have been referred to in connection with the other characters. A sensation of increased force of the pulse is incident to quickness and a large amplitude, indicating low arterial tension, or a feeble blood-pressure, rather than increase of the power of the ventricular systole. Abnormal strength is incident to hardness of the pulse, indicating cardiac power and strong arterial tension. Weakness of the pulse is shown by feeble resistance to pressure—that is, softness—and may be associated with either fullness or smallness. The *strong* pulse is generally noticed in inflammation of organs largely supplied with blood-vessels—as the lungs and liver—and is the more strongly marked in proportion to the degree of plethora of the patient. In plethoric individuals this state of the pulse is often the forerunner of hæmorrhage. The weak pulse is met with in nearly all diseases attended with exhaustion, and is common in the diseases of children, old persons, and women. It is most common in affections of a typhoid character, or in those which, in their advanced stages, assume this type, such as pneumonia, puerperal fever, phlegmonous erysipelas, and gangrene.

Irregularity of the Pulse.—"A form of irregularity is the want of uniformity in the rhythmical succession of the arterial pulsations. This irregularity may be either constant or occasional. A series of regular beats—that is, with normal rhythm—may be followed at short intervals by a series with a more rapid succession; in other words, variations in frequency may occur during the time that the fingers are applied over the artery. This occasional irregularity occurs in nervous subjects, and may be due solely to emotional influences. A constant irregularity is when the beats succeed each other without any regard to rhythm. This irregularity may or may not denote a corresponding irregularity in the heart's action. The heart may act with regularity when more or less of the ventricular contractions have not force enough to be represented by a radial pulse. To determine any discordance between the pulse and the heart, the physician should auscultate the heart while his fingers are on the artery. Another form of irregularity is when the successive pulsations lack uniformity in force; some beats are relatively strong and others weak. The pulse is then said to be unequal. These two forms are often associated. Exclusive of cardiac affections, they occur in diseases which occasion notable obstruction of the pulmonary circulation—namely, pneumonia affecting two or more lobes, capillary bronchitis, œdema of the lungs, pleurisy with large effusion taking place rapidly, and hydrothorax. A pulse in these diseases irregular in rhythm and unequal, together with weakness, denotes over-distention of the right cavities of the heart and an insufficient supply of blood to the left ventricle. In conjunction with the characters of the pulse just named, there is more or less lividity from cyanosis. These symptoms, appearing rather suddenly and, perhaps, unexpectedly, more especially in cases of pneumonia, render probable the formation of thrombus, or a heart-clot, in the right cavities. Without as well as with this event, they render the prognosis extremely unfavorable. Intermittency of the pulse is another form of irregularity. The heart's action is suspended for a period which would have been occupied by one or more beats occurring in regular succession. Intermissions may occur without the other forms of irregularity. Occurring with regularity in other respects, they may denote a normal peculiarity. Some persons have an intermittent pulse which is natural, and the pulse in some persons becomes intermittent with advancing years, without other evidence of disease. Under these circumstances it has no special significance. A marked point of

distinction, when it is not a morbid symptom, is, that it occurs unconsciously; whereas, when it is a symptom of functional disorder of the heart, the patient is painfully conscious of it, and it is apt to excite much apprehension of sudden death, although attended with no actual danger. The tracings of the sphygmograph show that the pulsations directly following intermissions have an increase of force. An approach to an intermission occurs in what has been called a "faltering pulse." This form of irregularity consists of a little delay from time to time in pulsation. Now and then a pulsation seems to lag. It is a symptom of cerebral affections, and is sometimes of value in diagnosis.

"The average numerical proportion of the arterial pulsations to the respiratory movements is 4 or 5 to 1. When this proportion is widely departed from, there is either some general diseased condition of the system, accompanied with fever, some obstruction to the proper aëration of the blood, or disorder in the nervous system. In inflammatory or acute diseases the pulse may rise from 120 to 160 in the adult, and become so rapid that it can not be counted in the child. In pneumonia we have a quickened pulse; but the number of respirations increase more rapidly, so that the above proportion becomes as 3 to 1, or even 2 to 1. In hysteria a similar increase may occur without any serious cause. The most important modification of the *rhythm* of the pulse consists in its increased frequency—that is, beating more frequently than usual in a given space of time. To measure with accuracy the degree of its frequency, a watch furnished with a second-hand should be used. When the pulse is beating very rapidly, it is best not to count beyond ten, noting the number of seconds required for that purpose, and renewing the count after a quarter or half a minute has elapsed. The advantage of this plan is, having time to think of numbers expressed by words of one syllable only, the operation is more rapidly performed than when the dissyllabic numbers above ten are employed. In this way it is possible to count 180, and even 200, pulsations in a minute. A pulse above 120 in adult patients is evidence of cardiac weakness, the heart seeming to make up in frequency what is lacking in force. Acceleration of the pulse is the common symptom of all febrile disorders. It augments with their increase and subsides with their decline, and is generally proportioned to the heat of the skin and the frequency of the respiration. Its diminution is often one of the first symptoms of the decline of disease. When the pulse continues to be frequent without appreciable cause, although the other symptoms appear to improve, no permanent amelioration is to be anticipated; either the original disease will resume its course, or some intercurrent complication be developed. When this acceleration occurs at regular intervals, it is one of the chief evidences that the disease is assuming a remittent type and has important relations to treatment; but, if it take place in the evening, it is often an evidence of hectic fever, and must be regarded as unfavorable, especially if preceded by chilliness and followed by perspiration. It is difficult to fix any point above which the number of pulsations ought to be regarded as febrile, especially during the decline of disease, for then the state of nervous excitability which often exists in many acute affections renders the pulse frequent and the skin slightly warm; and, in order to prevent these effects, nutritious food is generally required, instead of a low diet and febrifuge remedies. In all cases of doubt the thermometer should be employed. It can not be said of the pulse that it furnishes diagnostic symptoms of particular diseases, but it enables the physician to judge of important pathological conditions involved in different affections. It suffices for the exclusion of fevers and inflammations, and in this way is of much aid in diagnosis. It affords information concerning the favorable or unfavorable progress of acute and chronic diseases, and is thus of value in prognosis. It supplies rational indications for treatment relating to the frequency and strength of the heart's action, and the employment of measures for either increasing or diminishing arterial tension. In these several practical aspects the characters of the pulse claim careful study and attention."

Symptoms relating to Respiration.—Respiration consists of two parts—inspiration and expiration. The normal respiration per minute in a child under a year is 40 to 50; from 1 to 2 years, 35; from 2 to 12 years, 18 during sleep and 23 waking; from 12 to 15 years, 18 sleeping, 20 waking. In a healthy adult male, about 18 times a minute. In women and children it is quicker and louder—about 22 times a minute. Respiration is rendered much more frequent by exercise, by mental emotion, and by the process of digestion; but the action of these causes is very brief, and, when it has ceased, the breathing resumes its previous moderation. Inspiration occupies about twice the time of expiration, though a different proportion is not incompatible with health when of transient duration. The *abdominal movements of respiration* differ much in the two sexes. The ordinary calm breathing of a *man* is effected mainly by the descent of the arch of the diaphragm, so that, in counting the respirations of a male, the hand should be applied to the epigastrium. But in *women* and *children* the thoracic expansion is greater, and the abdominal movement less; hence, in counting their respiration, the hand should be placed over the upper third of the chest.

In disease, the respiration may be preternaturally frequent or slow, rising to 60 or 80, or falling 8 or 10 in a minute. Increased frequency of respiration is common to all febrile and inflammatory affections of sthenic type, especially when they attack children, and denotes increased oxidation and tissue metamorphosis. As a general rule, however, extremely rapid breathing is a symptom of thoracic disease; but even then it is proportioned to the degree of fever present, unless when associated with dyspnœa, in which case its degree more directly depends upon the amount of pulmonary tissue withdrawn from the purposes of respiration by disease. When, from any cause, the inspirations are short and very frequent, and particularly when this effect is produced by extensive effusion into the pleural cavities, the breathing resembles that of a person "out of breath" with running, and is called *panting respiration.* As mental emotion quickens the respiration temporarily, so do certain nervous diseases increase its frequency more permanently. It is not uncommon for hysterical females to breathe 60 or 70 times a minute during an entire paroxysm of the disease.

Slow respiration is seldom if ever attendant upon pulmonary disease, but nearly always upon some affection, either structural or functional, of the nervous system. It is observed in apoplexy, effusion of serum within the cranium, softening of the brain, and in most of the circumstances which occasion coma. In nearly all these cases not only is the respiratory act very slowly performed, but the intervals between the inspirations are unusually long. A similar condition is met with in catalepsy, ecstasis, melancholia, monomania, and in persons under the influence of depressing passions. Inspiration, as has been stated, is naturally longer than expiration. Sometimes this proportion is exaggerated and sometimes reversed. For example, in œdema of the glottis the swollen edges of the opening are drawn downward so as to obstruct, and therefore prolong, the passage of the air into the larynx; but they offer no impediment to its escape, so that the expiratory act is short and easy. On the other hand, when the lungs are emphysematous, the air enters them readily; but, in consequence of their rigidity, they contract slowly, and therefore a prolonged expiration is produced. Normal inspiration is uniform and continuous; but when the pleura is inflamed, or the muscles of the chest are affected with rheumatism, the pain caused by drawing the breath arrests the expansive movement at every instant and renders the inspiration jerking and irregular. Irregularities in the succession of the respiratory acts are not diagnostic of diseases affecting the respiratory system. They are symptoms of cerebral affections, and are among the numerous and varied manifestations of hysteria. A remarkable rhythmical disorder coming under this head is that known as the Cheyne-Stokes respiration, so called because each of these observers described it. It consists in the occurrence of a series of inspirations increasing to a maximum, and then declining in force and length until a state of apparent apnœa is established. In this con-

dition the patient may remain for such a length of time as to make his attendants believe he is dead, when a low inspiration, followed by one more decided, marks the commencement of a now ascending and then descending series of inspirations. The whole cycle of the above phenomena is completed in about one minute and a half. The symptom is of very serious import, and usually denotes a fatal result. Stokes regarded it as a diagnostic symptom of fatty degeneration of the heart. It is not, however, limited to that affection. It occurs in some cases of uræmia. The following are the most important varieties of morbid respiration:

"*Abdominal* respiration, in which the diaphragm chiefly exerts itself, causing the abdomen to rise and fall considerably, while the walls of the chest are nearly at rest. This usually occurs in acute pleurisy, rheumatism of the chest, pericarditis, and fracture of the ribs—in all of which affections movements of the chest excite pain.

"*Thoracic* or *high* respiration, when the abdomen does not move and the act is entirely performed by expansion of the chest. This is found in a marked degree when the peritonæum, the diaphragm, or its pleural covering are inflamed. It may occur also from pressure of the gravid uterus in the latter months of pregnancy, and from distention of the abdomen due to enlargement of the liver, spleen, ascites, or ovarian dropsy.

"*Cervical* respiration is marked by considerable exertion of the superior ribs, sterno-mastoid, and other muscles of the neck. This form occurs in advanced stages of pulmonary or cardiac affection, obstruction, or disease of the larynx. It is usually attended by dilatation of the nostrils during the struggles for breath characterizing the severer forms of dyspnœa. In health, respiration is performed noiselessly, but not always so in disease. It is *wheezing* in simple laryngitis and in croup, and generally has a clear *whistling* tone in stridulous laryngitis and nervous asthma. It is *sighing* when the inspiration is short and quick and the expiration prolonged, as has happened during recovery from syncope, in low forms of fever, and often on the approach of death from asphyxia. It is *plaintive* or *moaning* either from extreme debility or from pain. When it occurs during sleep it is a most unfavorable indication.

"*Stertorous* respiration is a loud, grating sound in breathing, occasioned by relaxation of the velum palati and paralysis of the buccinator muscle, and is due to cerebral oppression. It is one of the frequent attendants of coma, and adds to the gravity of this symptom whenever the latter depends upon congestion or any other mode of pressure upon the brain. But it may depend merely upon the habit of the patient or upon a polypus tumor in the nostrils—cases of which, of course, must be distinguished from those where it forms an incident of the principal disease."

Dyspnœa includes any form of laborious or difficult respiration, accompanied with a sense of constriction or oppression around the base or on the front of the chest. Its causes, although very numerous, may, perhaps, be all resolved into one general and essential cause—*an obstacle to the due aëration of the blood.* A healthy person exhausted by exercise or running has dyspnœa, because the natural supply of air afforded by the lungs is insufficient to modify the blood which rushes in a greatly augmented quantity into those organs. The increased respiratory action is nature's method of maintaining the balance between the functions of the heart and lungs. But whether the circulation be increased in activity or the lungs so altered as to admit but little blood to come in contact with the air, or the heart or great vessels so changed as to impede the passage of the blood toward the lungs, or the respiratory muscles too feeble to dilate the chest, one and the same result ensues: enough blood is not aërated to supply the wants of the economy, and a more or less vigorous and successful effort is made, by means of the voluntary muscles, to expand the chest and relieve the sense of suffocation which incites the effort. Consequently, whether the disease be an effusion of blood or serum into the pericardium compressing the heart, or such a state of th organ as causes it to propel an undue quantity of blood into the lungs, or

diseases of its valves as either prevent the blood from reaching the lungs or from passing freely from them; whether the lungs themselves be hepatized or infiltrated with tubercle, or have their cells thickened by emphysema, or choked up by mucus or blood, as in bronchitis, a pulmonary hæmorrhage, or compressed by gas, pus, or serum, as in pneumo-thorax, empyema, and pleurisy; or whether, finally the respiratory muscles be weakened or paralyzed by cerebral disease—the consequences are still the same: the blood fails to undergo the changes for the accomplishment of which the pulmonary circulation exists, impending suffocation gives warning of the mischief, and a laborious attempt is made to overcome the incompleteness and inadequacy of the respiration generally by rendering it more frequent. Dyspnœa is more or less severe according to the nature of the disease, and the extent of the lesion. It is especially marked in double pneumonia or pleurisy, when hardly any of the pulmonary tissue is left in a condition to perform its normal function. It is not extreme in tuberculization of the lungs unless this has taken place to a great extent. Diseases of the heart, and emphysema, when general, create very distressing shortness of breath, because they influence the function of the whole pulmonary tissue. In most of the affections of the lungs and heart, attended with dyspnœa, this symptom is of gradual growth, and its increase shows the progress of the original disease. Sometimes, on the contrary, the invasion of this symptom is sudden and justly alarming, for, if accompanied with sinking or collapse, it nearly always indicates a rupture of the aorta or perforation of the pleura by a pulmonary vomica. In organic disease of the heart and in emphysema, dyspnœa is often paroxysmal in character, and may occur at regular intervals, particularly at night, or rather early in the morning. In suffocative diseases of the larynx—as pseudo-membranous laryngitis (croup), stridulous laryngitis, and œdema of the glottis—the same tendency is observed. There are two diseases—nervous asthma and angina pectoris—of which almost the only essential phenomena are paroxysms of dyspnœa; for, although in the former malady there is the most intense suffering from want of breath, and in the latter the most excruciating pain, extending from the breast to either arm, yet in the intervals between the attacks the patients may enjoy excellent health.

In conclusion, it should be borne in mind that symptoms referable to respiration do not always denote disease of the respiratory system. Morbid conditions relating to the circulation and the nervous system are represented by increased and diminished number of the acts of respiration and by rhythmical irregularities. The respirations are increased in frequency in proportion as the action of the heart is abnormally frequent. This is observed when the circulation is excited by exercise, mental emotion, or the febrile movement. As a rule, when there is an increase in the number of respirations, irrespective of disease of the respiratory system, the normal relation to the heart's action is preserved—that is, there are *four beats or arterial pulsations to one respiratory act*. Any considerable deviation from this numerical proportion is evidence of disease affecting either the *heart or the respiratory system*. There are, however, exceptions to this rule. Thus, the respirations are sometimes very frequent in hysteria, while the action of the heart remains normal. Of course, in determining that the respirations are abnormally either increased or diminished, the normal variations in number presented at the beginning of this article are to be considered.

Symptoms relating to Variation of Temperature.—Before discussing the laws of thermometry pertaining to disease, the range and laws of normal temperature ought to be well known. The axillary temperature in health ranges from 98° to 99°, the average being about 98·5° F. It is true these degrees do not express fully the range of variation within the limits of health. It is about 1° higher in tropical than in temperate climates. The temperature may be raised a degree by active muscular exercise or a full meal, and it may be somewhat lowered by mental labor, or after exhaustion from physical exertion. Other causes, not always appreciable, may produce, within a limited range, a temporary rise or fall of the average temperature. And it is

also known that the normal temperature fluctuates during the twenty-four hours, irrespective of any special cause. It is lowest early in the morning and highest late in the afternoon, the range of diurnal fluctuation being from 1° to 2°; it takes place in health as well as in disease, and is uninfluenced by ordinary habits of living. The temperature is 1° to 2° higher in children than in adults. The practical rule for distinguishing a morbid temperature is not to consider a rise of 1° to 2° as morbid, provided no other symptoms of disease be present, unless the rise has persisted for at least several hours. This rule is based upon the fact that a slight or moderate increase of temperature, irrespective of disease, is of transient duration. A similar rule applies to a temperature somewhat below the ordinary healthy average. The axilla is generally the best place for examining the temperature, and the thermometer should be kept in this situation from three to five minutes.

"The variations of temperature which are symptoms of disease may be either above or below the normal range, but the former variations are by far the most frequent. A morbid increase of temperature is evidence of the state of fever. Either some one of the essential fevers exists, or the fever is symptomatic of some local affection. A temperature, therefore, at or below the maximum of healthy variations is sufficient to exclude all febrile and acute inflammatory diseases, this law being true in all cases except where the temperature falls within or below the normal limits as an effect of certain events, as hæmorrhage, or in which it has been reduced by measures of treatment. A rise of temperature in fever of 1° F. corresponds, as a rule, with an increase of the pulse of eight to ten beats per minute; but the thermometer furnishes the only reliable criterion of the intensity of the febrile state." The temperature has been found the highest in scarlet, yellow, and thermic fevers, in tetanus, and injuries of the spinal cord. In these affections it sometimes ranges as high as 108° to 112° F. The whole range of deviation of temperature within which life can be well maintained is comprised between 90° and 110° F. A temperature approaching either end of this range indicates a condition of extreme danger. With reference to the general condition of patients who present an abnormal temperature, the following distinctions may be noted:

A temperature below 97° F. is that of *collapse*. When from 97° to 98° F. it is *sub-normal*. From 98° to 99·5° F. it is *normal*. A temperature from 99·5° to 100·5° F. is *sub-febrile*. A *febrile temperature of moderate degree* is from 100·5° to 102° F. mornings, and 102° to 103° F. evenings. A *febrile temperature of high degree* ranges from 102·5° F. and more mornings, or 105° to 106° F. in the evening. While a *temperature of hyperpyrexic degree* is from 105° to 107° F. and more, and, if persistent, is extremely dangerous to life. These high degrees of temperature, however, may denote an intense febrile paroxysm, as in malarial fever, diminishing during the stage of sweating at the rate of from 1° to 2° every ten minutes until reduced to 98° F., or a half degree below the normal.

A decline of temperature below the normal limits is far less frequent than an abnormal increase of body-heat. The following are the conditions under which a decrease occurs: In cases of epidemic cholera, characterized by algidity, the temperature may fall to 92° F. It falls considerably in some cases of the algid form of pernicious intermittent fever, and in certain cases of collapse occurring in other pathological conditions. It is sometimes lowered just before death in some chronic affections; whereas in fevers and acute inflammations the moribund state is often characterized by a notable increase of body-heat. But in certain non-inflammatory affections which occasion disturbance of respiration or of the circulation, such as asthma, emphysema, and certain cardiac lesions, the temperature is below that of health. It is abnormally decreased in some cases of insanity, in the state of exhaustion due to sudden vomiting or diarrhœa, and in chronic nephritis, especially when accompanied by general dropsy. Hæmorrhages also occ sion an abnormal decrease; and, finally, in the defervescence which acc

panics convalescence from febrile and inflammatory diseases, the body-heat like the pulse, often falls below the minimum of health.

The use of the thermometer is of the most valuable diagnostic aid—sometimes, in a general way, in showing when disease is present, when perhaps no other symptom points to it; but also for the diagnosis of special diseases in some instances. "Where there are other symptoms of disease, the discovery of an abnormally high or febrile temperature may at once give quite a different aspect to the case, as, for instance, when a patient who has been suffering for some time with a troublesome cough, but in whom the most careful examination of the chest could not detect any lung disease, is found to have pyrexia. The suspicion that there is commencing phthisis may be thereby at once confirmed or aroused for the first time. Or, again, where the patient simply complains of dyspepsia or lassitude, the thermometer may give a degree of heat which would not have been expected either from the looks of the patient or from the temperature of his hands or skin, and the attention may thereby be at once directed to the possibility of the case being one of typhoid or some other specific fever. A person, yesterday healthy, who exhibits this morning a temperature above 104° F. is almost certainly the subject of an attack of ephemeral fever or of ague. Should the temperature rise to 106° or beyond, the case will certainly turn out one of some form of malarial fever. It certainly is not typhoid fever. In a patient who exhibits the typical signs of pneumonia, but whose temperature never reaches 101·5° F., it may be concluded that no soft infiltrating exudation is present in the lung. Again, if a child is taken with a sudden illness attended with a chill, vomiting, hot skin, and a very rapid pulse, and the temperature is immediately taken and found to record 105°, or anywhere up from this even to 110° and 112°, this will always denote scarlet fever, as there is no other disease of childhood in which such a high temperature is developed with such rapidity. Usually the thermometer indicates 105° to 107°, and from this fact alone, even without sore throat and before the eruption has made its appearance, the diagnosis of scarlet fever can be made. Perhaps, without any premonitory symptoms, a patient is seized with a chill, followed by rapid breathing, a dull pain in the chest, cough, high fever, and *a comparatively slow pulse*. If the thermometer indicates a temperature of 104° or 105° F., while the pulse does not beat over 110 per minute, but the respiration is rapid, the diagnosis of acute croupous or lobar pneumonia will always be accurate, because there does not exist any other disease with which a rapid breathing and such a high temperature are connected with so slow a pulse. Often the frequency of the pulse will not be increased at all, or only by a few beats, and it is not rare to find cases of acute pneumonia with a pulse of 84 to 9[illegible]. Should the pulse exceed 120 per minute, the case will likely prove fatal. If, in a case of bronchitis, the breathing suddenly becomes more difficult and the temperature rises to 103° or 104°, it is an indication that catarrhal pneumonia has set in. If, in a case of chronic pneumonia, or at the period of acute pneumonia when resolution should begin (that is, from the seventh to the eleventh day), the same sudden rise of temperature again takes place, it denotes breaking down of lung-tissue. If, in a case of pleuritic effusion, the temperature suddenly ascends to about 104°, then declines during the following sweating about 2·5°, and a similar rise and fall take place daily at almost the same hour, it denotes that the effusion of serum has changed into pus, and that the case has become one of empyema; while a similar temperature record accompanies galloping phthisis and the hectic fever of common tubercular consumption. And so, in all cases of suddenly developed severe inflammations of internal organs, or breaking down of their tissue, or internal formation of pus, an increased body-heat, in part at least, is due to a morbid activity of molecular change incident to disintegration of tissue, and the use of the thermometer will at once reveal the lurking danger. Without its recording a high temperature, apparently grave symptoms immediately lose their perilous aspect. Thus, for example, a patient may be suffering from *pleurodynia*, a painful affection of the thoracic muscles, or else with *inter*

costal neuralgia, a neuralgic affection of the intercostal nerves. These affections, as respects the character and sometimes the intensity of the pain, have a striking resemblance to pleurisy and pneumonia. But the thermometer at once decides the question by denoting the *absence of fever*. The neuralgic affections are always unattended by an elevation of body-heat, unless by accidental association. Again, if an hysterical female be suffering, for instance, with acute articular rheumatism, should suddenly complain of intense headache and wander in her mind, or is seized with severe pain in her chest, commences to breathe with difficulty and the heart to beat irregularly, one might well be alarmed as to the existence of cerebral rheumatism on the one hand, or of endocarditis on the other; but, if the thermometer does not indicate a sudden rise of temperature in either case, then such dangerous complications may be safely excluded. Again, a lady might be suffering from intense abdominal tenderness and pain, with vomiting. Peritonitis seems to be threatening: but, no matter how long or how carefully applied, the thermometer does not register more than 98·5°. We know at once that we have to deal with one of the protean forms of hysteria simulating peritonitis, in which this instrument of precision alone tells the truth. Again, a man, during the heat of the summer months, suddenly drops down unconscious. Is it apoplexy, or sun-stroke? If apoplexy, the temperature sinks below the normal, generally to 97°; but it may fall to 95°, and, what is important to know, if, after creeping up, it should again decline, that such fall indicates that more blood is oozing out—that another hæmorrhage is still compressing the brain. On the contrary, in a fully developed case of sun-stroke the thermometer will never record less than 107° or 108°. And while in apoplexy the renewed fall generally denotes death, in sun-stroke a gradual decline to the normal indicates returning consciousness and recovery." In the diagnosis of small-pox from measles much important aid is afforded by the temperature. In variola, during the initial stage, the temperature ordinarily rises to 104° or 105°, while in measles, during the corresponding stage or period, it seldom exceeds 102° or 104°; but it is also characteristic of variola that, *soon after the eruption appears*, *the temperature falls*, while in measles it continues the same, or even rises. This peculiarity distinguishes small-pox from the other exanthematous fevers, and especially scarlet fever. Certain fevers have been found to have typical ranges or daily fluctuations of temperature throughout their course, so that differential diagnosis may be greatly assisted. This has now been determined, especially in malarious, typhus, typhoid, and scarlet fevers; also in variola, measles, rheumatism, pyæmia, pneumonia, acute tuberculosis, and in many other febrile disorders. Hence a *systematic series of observations* is of much greater value than *isolated observations of temperature*. By the regular and continued watching of the course which the temperature takes in disease, our diagnosis and prognosis, as well as indications for treatment, are often rendered much more clear than could be possible from any single observation of temperature. Many diseases present a deviation from the normal temperature, showing a typical course as regards duration as well as the daily fluctuations of the abnormal temperature. The mode of rising of temperature so varies that in this way some diseases may be distinguished from others. In some diseases a contraction of the peripheral arteries takes place at the onset which, by diminishing the peripheral circulation and the giving off of heat, leads to a rapid rise of temperature, and is accompanied by a sensation of cold. In pneumonia, therefore, and other diseases commencing with a rigor, the temperature rises rapidly and continuously to a height beyond 104° F., whereas diseases with a more gradual beginning show simply a slow elevation of the normal range, both morning and evening temperatures becoming gradually higher, and the usual daily fluctuations being maintained. Thus, in typhoid fever the temperature rises every evening about 2° F. above what it is in the morning, but declining again about 1° or 1·5° the following morning. The maximum of about 105° F. is only attained on the sixth or seventh day.

At the height of a disease the temperature may fluctuate round an average temperature of 103° F. or more, while it shows the same daily course as in health—that is, being lowest in the morning and highest in the evening. The range of this temperature may, however, differ considerably in different diseases. According to the extent of the daily fluctuations, three types may be distinguished—the *continuous*, the *remittent*, and the *intermittent*. In the first type the daily fluctuation of an elevated temperature shows only the normal difference, or even a smaller difference, between the morning and evening temperatures. In the second type the difference is greater than the normal, the remissions having a tendency to a low temperature and the exacerbations to a considerable rise. In the third type the remissions reach the normal, or recede even below it. The first type is observed soon after the commencement of disease and during its height; the second type during the decline of some acute diseases and in chronic inflammatory affections, especially of a tubercular nature or in chronic syphilitic disorders, the remissions generally becoming more marked as the exhaustion of the patient increases; the third or intermittent type of pyrexia is most conspicuously shown in malarial diseases, in which the elevation of temperature may follow the quotidian, tertian, or quartan variety.

The intermittent also sometimes occurs in chronic tubercular disease of the lungs. In the great majority of cases the daily fluctuations of temperature follow the rule of health, the exacerbations taking place in the evening; but we sometimes meet with cases in which this order is reversed, the rise taking place in the morning, the remission taking place in the evening. This "*inverse*" type has been observed more frequently in chronic lung disease, while in doubtful cases of inflammation of the lungs it has some significance as to the disease belonging to the class of phthisis.

"Any *irregularity of the course* of the temperature in a disease which, as a rule, runs a very regular and definite course, is indicative of some disturbance or complication, and its early detection is therefore important for diagnosis no less than for prognosis and treatment.

"The *decline of the elevation of temperature* at the termination of disease may be gradual or by *lysis*, or it may be rapid; the latter mode is called *crisis*. Diseases in or by which an organ has become materially altered, as by an injury or in the course of an infectious disease of long duration, show a slow decline of temperature with a tendency to a remittent type. The repair of the damaged structures taking some time, the decline of the pyrexia is slow, and the defervescence by lysis. This is the mode in typhoid fever, in which the specific process produces deep alterations in the glandular structure of the intestines, which persist for some time after it has terminated. The same is observed whenever an organ is altered by an inflammatory process, be this of traumatic or of infectious origin.

"On the contrary, diseases caused by the action in the system of some foreign substance—as, for instance, some infective agent, its action being of limited duration—have a tendency to critical defervescence. This is the case in acute pneumonia, erysipelas, typhus, relapsing fever, and measles, when not complicated with more serious inflammation."

In *convalescence*, owing to weakness of the nervous system from previous illness, the temperature is more easily influenced by external causes as well as by internal changes than in perfect health, and so the approach of a relapse or complication is at once indicated by a rise of temperature. Hence the continuance of the regular thermometrical observations in the first period of convalescence is of very great importance, the more so as convalescents are sometimes not sensible to changes which at first only show themselves in alteration of temperature.

Prognostic Symptoms from Temperature.—"When the temperature is increased beyond 98·5° F., it merely shows that the patient is ill. When it is raised as high as 104° to 105°, the febrile phenomena are severe. If above 105°, the patient is in imminent danger. With a temperature of 108° or 109°, fatal issue may without doubt be expected within a comparatively short

time. If a patient suffers from measles and retains a high temperature after the *eruption has faded*, it may be concluded that some complicating disturbance is present. In typhoid fever a temperature which does not exceed any evening 103·5° F. indicates probably a mild course of the fever, but 105° in the evening or 104° in the morning shows danger in the third week. In pneumonia a temperature of 104° and upward indicates a severe attack. In acute rheumatism a temperature of 104° is always an alarming symptom, foreboding danger or some complication, such as pericardial inflammation. A fever temperature of 104° or 105° in any disease shows that its progress is not checked, and complications may still occur. In continued fevers the temperature is generally less high of a morning than of an evening. Stability of temperature from morning to evening is a favorable indication. On the contrary, if a high temperature does not decline from evening until morning, it denotes that the patient is getting or will get worse. When the temperature begins to fall from evening to the morning, it is a sure symptom of improvement; but a rise of temperature from evening until the morning is an indication of the patient getting worse. In the second week of typhoid fever, if the morning and evening temperatures are alike, if no decline of even 1° takes place, the prognosis is the very worst possible. Such cases almost invariably end in death, and the same holds true of any other disease. The degree of persistent fever-heat has a positive bearing on the prognosis; thus, a temperature of 105°, if it persist for twenty-four hours or longer, denotes considerable gravity of disease. If the temperature reach 106° or 107°, and *persist*, the danger to life is immediate and very great." In a case of suspected phthisis, if the patient shows no elevation of temperature, it is evidence that the patient does not have the malady, or that it has been arrested in its progress. There is *no consumption without fever*. If, in a case of typhoid fever, at any time between the eleventh and nineteenth day, the temperature suddenly declines 4° to 6°, hæmorrhage from the bowels may with certainty be predicted. A fall of temperature in certain cases of collapse connected with various pathological conditions is always dangerous in proportion to its degree. A temperature of 95° is extremely dangerous, and one at 92° is hopelessly so, unless due to alcoholic poisoning. On *the approach of death*, in many chronic diseases, the temperature is gradually lowered; but instances are not rare, especially in fevers and acute inflammations, in which the moribund state is characterized by a notable increase of body-heat, reaching sometimes hyperpyrexic degrees. In scarlatina and other infectious fevers it may continue to rise after death from diminished heat-loss, the result of stoppage of circulation through the skin. Convalescence does not begin from disease, until the normal temperature of the body returns and maintains itself unchanged through *all the periods of day and night*.

In conclusion, it should be stated that the physician should only use a self-registering thermometer in making his observations relating to temperature, and it should be an instrument of *guaranteed accuracy;* and, before using it, he should see that the upper (index) column of mercury registers less than 98·5° F., this being the normal temperature of the healthy human body. Usually the thermometer may be applied in the mouth; if this can not be done, in the axilla, and, in certain cases, in the rectum. With children the inguinal region is often the most available situation. But, no matter how the temperature is taken, the observations should be made at least twice daily in important cases, and for a period of from three to five minutes, or even ten minutes, if the instrument is slow to register. For the purpose of diagnosis, prognosis, and treatment, as well as for future reference and comparison, the physician should keep a record of his cases. The number of respirations and pulse-beats at the same time should be noted, together with the effects of remedies employed in special indications. In the investigation and treatment of febrile and inflammatory diseases the evidence of the *thermometer* should not stand alone. It should be supported especially by that of the *pulse* and *respiration*, noting at the same time the effects of the *remedies* employed. The actual temperature at a given time, being an isolated fact, is of little valu-

We should consider the period of the disease to which it belongs and connect it with the ascending or descending scale of temperature. It is the persistence of fever as well as hyperpyrexia which is so dangerous, and the nature of its variations which is so instructive.

Knowing, therefore, the importance of keeping a daily record of temperature in many diseases with reference to diagnosis, prognosis, and treatment, the author has devised accompanying blank charts, to be found at the end of this work, which, he trusts, for convenience of use, will fill a long-felt want with the busy practitioner of medicine.

Symptoms relating to Pain in its Various Forms and Situations.—The aid which pain affords in diagnosis is frequently of higher value than that of any other single symptom. The several varieties of pain have received different names, expressive of their peculiar characters, which in many instances are sufficient for the discrimination of diseases.

Dull, heavy, or aching pain is generally caused by the weight of some enlarged or congested organs, by the dragging of an internal tumor, or by an effusion into some serous cavity. In females, when felt in the loins, it frequently precedes the menstrual flow; and in males, the formation of hæmorrhoids. It belongs to congestion and inflammation of mucous membranes, inflammation of parenchymatous organs, as pneumonia and some chronic inflammations.

Tensive pain exists when the parts are put upon the stretch, as when the variolous eruption is about to appear or to maturate, or when purulent collections are forming in the cellular tissue. It is commonly accompanied with a *throbbing* sensation in acute abscesses, with *burning* in erysipelas, cutaneous inflammations generally and carbuncles, with a sense of *gnawing* and *tearing* in gout and rheumatism, perforating in inflammation of the periosteum and bones; the latter form is common in the tertiary stages of syphilis, and is most intense at night, as is the case with most of the pains accompanying the fibrous and osseous tissues.

Lancinating, or sharp and darting pain, is met with chiefly in neuralgia, rheumatism, and cancer; it seems to follow the course of the nerve-trunks, and is felt only for an instant in its greatest intensity, succeeded by intervals of no pain, or one that is dull and contusive. In the several forms of abdominal paroxysmal affections, which go under the general name of "colic," the pain is at the same time lancinating and tensive. It is sharp, acute, and very severe in inflammation of a serous membrane. But the degree of pain caused by disease is no measure of its gravity. The most dangerous maladies—such as fevers, inflammation of the lungs, liver, and kidneys, pulmonary phthisis, and hydrocephalus—are attended with but little pain, and, even when the inflammation of a parenchymatous organ extends to its investing serous membrane, the increase of pain is scarcely evident so long as the patient remains completely at rest; and, even when excited by pressure, it is never so intense as that of *tic douleureux*, or of lead and other colics, which are seldom fatal. The pathological evil of pain is that it causes distress and exhaustion of nervous energy, interferes with sleep, interrupts the appetite and digestion, so that the nutrition of the body is damaged, and thus, if long-continued, it can lead to changes shortening existence, or it may be so severe in some instances as of itself to cause death. In fact, few persons can endure prolonged and unremitting pain; its presence, therefore, is of evil augury. Movable or wandering pain is less serious than such as is fixed, and external than deep-seated pain. When pain ceases and at the same time the strength suddenly fails, the pulse grows weaker, and the face sunken, it is often a sign that the affected parts have been attacked with gangrene and have lost their previous sensibility. For a similar reason the prognosis must be unfavorable when inflammatory or other complications which are usually painful arise without attracting the patient's attention. Pain confined to a single organ, and seeming of itself to constitute the whole disease, is commonly regarded as a form of neuralgia, and receives a corresponding name. Thus have gastralgia, enteralgia, nephralgia, etc.—that is to say, neuralgic pain

of the stomach, bowels, kidneys, etc. There is one organ, however (the head), which is the seat of some degree of pain in nearly every acute disorder —in all, at least, attended with fever, besides having its own local and peculiar pains. *Cephalalgia*, or headache, is a term used to designate a variety of pains in the head.

Significance of Pain relating to its Situation.—Pain generally indicates the seat and nature of the disease. But this may not always follow, as pain in the right shoulder may denote inflammation of the liver; at the end of the urethra, stone in the bladder; down the leg, chronic inflammation of the ovary of the same side; in the knee, inflammation of the hip-joint; on top of the head, erosions of the cervix uteri or displacements of this organ. In these cases the pain is of reflex character, operating through the sympathetic nervous system.

Pain in the Head.—This, when of a continuous dull, aching character, may be due to rheumatism of the scalp. Of a similar character, affecting the forehead, may be dependent upon indigestion. Fixed in one spot, either on the head or face, and darting from that spot, if sharp and paroxysmal, is likely to be neuralgic. If, in addition, it be accompanied by vomiting and giddiness, it may indicate migraine; but the latter affection rarely endures more than a day at a time. Should these symptoms, therefore, continue beyond this period, they should be regarded with anxiety, as probably indicating brain mischief. If these symptoms be accompanied by squint, or some other evidence of localized paralysis of a cranial nerve, it is almost certainly due to intra-cranial disease, such as tumor, aneurism, abscess, hæmorrhage, or meningitis. In all cases of persistent pain in the head, the urine should be carefully examined, not only for albumen, but also for sugar. Pain of a severe kind in the back of the head is often found in the course of Bright's disease and glycosuria. A recurrent pain in the head of excessive violence is often dependent upon syphilis. Pain in the head which accompanies chlorosis is often fixed in one spot, and is described by the patient as a feeling of a nail being driven into the head. This symptom not infrequently belongs to hysterical conditions.

Pain in the neck is often due to rheumatism affecting the fibrous covering of the large muscles. When of paroxysmal character, and independent of muscular movement, it is neuralgic.

Pain in the Chest.—This may be referred to the chest-wall, or to the interior of the cavity. In the former case it is necessary to determine whether the pain be due to muscular rheumatism, syphilitic periostitis, intercostal neuralgia, or the encroachment of a tumor. Absence of febrile movement, as shown by the thermometer, and the entire dependence of the pain upon movement, points to the first of these causes. A node perceived by the finger upon the sternum, clavicle, or ribs would indicate syphilitic periostitis. The character of the pain and the presence of tender points, coupled very probably with a history of previous neuralgic attacks in some other part of the body, suggest intercostal neuralgia. The elevation of the temperature would indicate pleurisy. Continued dull pain deep in the chest may indicate an intra-thoracic growth, abscess, or aneurism, which may be ascertained by physical examination. Pain is often experienced about the heart more or less early in acute rheumatism, and may be dependent upon commencing pericarditis or endocarditis, which will be disclosed by the stethoscope. A dull and more or less continued pain about the heart occurs in conditions of nervous debility, and is not connected with organic disease. Pain in the heart of an extremely sudden character, as though the muscles were being grasped, and accompanied by intense apprehension of death, with facial pallor and some dyspnœa, points to angina pectoris. The pain is not confined to the heart, but extends to the left arm and to various parts of the chest. The pain which belongs to pleuritic inflammation is sharp, lancinating, unilateral, and felt especially during inspiration. It is popularly known as stitch-pain. The pain in acute pneumonia has the same character, and is due to associated pleurisy. Pain is a symptom of the first stages of acute bronchitis. It is

rarely severe, and is felt chiefly in acts of coughing. It is of a dull, contusive character, and referred chiefly to the sternal region. Sharp, darting pains within the chest, occurring independent of the acts of respiration, and bilateral, are generally due to cancer.

Pain in the Spinal Column.—Acute pain and tenderness of any of the vertebral spines is a symptom, not of disease of the spinal cord, but of a peculiar state of nervous exhaustion. It is common in hysterical persons, and in others who have from any cause become greatly debilitated. As a rule, there is very little pain in the spine in diseases of the cord. In spinal meningitis the patient only complains of pain on movement, and especially if he endeavors to turn over in bed. In commencing caries of the vertebræ a stinging pain is often complained of in the chest-wall, and pain may also be complained of on pressing somewhat heavily upon a vertebral spine. In such a case, too, the act of stooping and lifting weights is apt to cause complaint of pain in the spinal column.

Pain in the Abdomen.—This may, like pain in the chest, be referred either to the abdominal wall or cavity. There may be inflammation and abscess of the abdominal wall. There may be neuralgia of the superficial branches of the lumbar plexus, in which case the pain is paroxysmal, sharp, and may be accompanied by herpes. But pain in this situation is more often myalgic, and will be found to correspond to the insertion of some abdominal muscle which is subject to over-strain or fatigue.

Acute abdominal pain referred to the contents of the belly may be dependent upon internal strangulation of the bowel, in which case it will be accompanied by vomiting, constipation, and, probably, by abdominal distention, with marked peristaltic writhings of the intestines. Or the cause may exist in a hernia which is strangulated. If pain in the abdomen be accompanied by tenderness on pressure, and be increased by coughing, there is, probably, peritonitis. In such a case the pulse will be found quick and small and the temperature somewhat raised. The patient will prefer to lie on the back, with the knees bent, and the face will betray anxiety. In hysterical women great abdominal pain and tenderness are often complained of, and it is sometimes not very easy to distinguish this from peritonitis. It is best done by engaging the patient's attention and noting that there is then no evidence of tenderness at a point which had been previously exceedingly painful. The pain and tenderness may be due to enteritis or perityphlitis, in which case there will be obstinate constipation, a tympanitic state of the whole intestine or the cæcum, and, most probably, vomiting. Cancerous tumors of various abdominal organs will have to be diagnosed by careful palpation and discriminated from fæcal accumulation. Colic, due to the poison of lead, causing violent abdominal pain without rise of temperature, requires to be distinguished from the symptoms which mark the passage of a biliary calculus. Extreme suddenness and severity characterize the latter, and there is usually more vomiting in the passing of a gall-stone than in colic. But the history will have to be investigated, and the evacuations, if any take place, should be examined. The absence of a blue line on the gums should be ascertained before the possibility of the existence of lead-colic is abandoned.

Pain in the Loins.—There are many conditions which give rise to pain in these situations, and which require to be borne in mind in examining a patient. Congestion of the kidneys, or nephritis, will be shown by the scanty, high-colored urine, containing albumen and probably blood. Renal calculus will be attended by unilateral pain in the loin, following the direction of the ureter and affecting the corresponding testicle. It is paroxysmal in character and often horribly severe. The urine will contain blood and possibly pus, and will be passed very frequently. As between such a condition and the presence of an abscess or morbid growth in the kidney the points of diagnosis are not strongly marked, careful observation will be requisite in order to -m an opinion. The presence of a bad stricture in the urethra, by causing tion and over-distention of the bladder with urine, will cause pain, re- not only to the hypogastric region, but also to the back.

Lumbago is characterized especially by inability of the patient to rise from his chair without the greatest distress, and only slowly and with difficulty. It may depend upon rheumatism of the muscles, or still more probably upon subacute inflammation of the connective tissue between the muscles. Or it may be neuralgic in character, in which case it will be acutely stabbing, paroxysmal, and independent of muscular movement.

"In *lumbo-abdominal neuralgia* the nerves affected are the branches of the lumbar plexus distributed to the hypogastrium, inguinal region, labia, and scrotum. The pain is referred to the back, generally on the left side, and extends to the parts just named; the pain is sometimes limited to the spermatic cord. Tender points in this affection are to be sought after near the lumbar vertebræ, on the crest of the ilium, above the symphysis pubis, and on the scrotum or labia." Pain in the back is frequently caused by flatulent distention of the bowels and by accumulation of retained fæces. It may be dependent upon a tumor connected with the bowel (especially likely in the sigmoid flexure and rectum), which may or may not be felt by external palpation or reached by the observer's finger introduced *per anum*. Nor must it be forgotten that an abscess in the wall of the rectum, or loose cellular tissue which surrounds it, will cause long-continued and severe pain in the back. So likewise flexions and morbid growths of the uterus, and ulcerations about the cervix, may be the cause of pain, as well as the approach of the catamenial period, which in some women is the cause of great pain in this situation.

Pains in the Extremities.—"These may be due to neuralgia, in which case they will be found to occupy the district of one or more branches of nerves, and to be paroxysmal in character. The pains which affect the extremities and the trunk, but especially the legs, in the early stages of locomotor ataxia, are peculiar in this. A patient who has little complaint to make of his health will every now and then be kept awake all night and incapacitated in the day by sudden sharp, lightning-like pains darting through one or more limbs, and often severe enough to make him call out. They will occur in paroxysms, lasting hours, days, or less—often weeks—and will subside as suddenly as they began. With such symptoms the patellar tendon reflex should always be tested.

Lumbo-Femoral Neuralgia.—"This name may be applied to neuralgia affecting separately or collectively the branches of the lumbar plexus which are distributed to the lower extremities, the largest branch being the crural nerve. Affecting the crural nerve, the pain is referred to the anterior aspect of the thigh, and extends along the inner side of the leg to the great toe. Affecting the external cutaneous nerve, the pain extends along the outer and anterior aspect of the thigh. A tender point is on the anterior-superior spinous process of the ilium. Affecting the obturator nerve, the pain extends along the inner surface of the thigh. Pain is referable to this nerve in cases of obturator hernia.

Sciatica.—"Neuralgia affecting the sciatic nerve is of frequent occurrence. Of the neuralgic affections now under consideration, sciatic, facial, and intercostal neuralgia, in the order mentioned, occur more frequently than all the others. The pain in sciatica is referred to the posterior part of the thigh, shooting down to the gastrocnemius muscle, and thence to the external aspect of the leg and foot. The course of the pain, as delineated by the patient, corresponds to the distribution of more or less of the branches of the sciatic nerve. Tender points are situated on the sacrum at the sciatic notch, behind the trochanter major, in the popliteal space on the external aspect of the patella, at the articulation of the tibia and fibula, over the lower and posterior part of the external malleolus, and on the upper part of the sole of the foot. The tenderness is present at more or less of these points according to the number and extent of the nervous branches involved.

Cervico-Brachial Neuralgia.—"The sensory branches of the four lower cervical nerves and the first dorsal nerve are the seats of pain in this group of neuralgic affections. The directions of the shooting pain correspond to

the several divisions of the nerve; namely, the musculo-cutaneous, radial, median, and ulnar. Of these several divisions, the last one named is oftenest affected. Tender points are found near the cervical vertebræ, in the neighborhood of the acromial end of the clavicle, over the deltoid muscle, in the axilla, at the inner end of the condyle of the humerus, and near the lower end of the radius and ulnar."

The essential seat of every true neuralgia is the posterior root of the spinal nerve in which the pain is felt, and the essential condition of the tissue of that nerve-root is one of atrophy, which is usually non-inflammatory in origin. The affection appears to be most frequently a development of hereditary neurosis, and is not infrequently associated with other neurosal disorders—such as insanity, epilepsy, paralysis, chorea, alcoholism—and this neurotic disposition is sometimes complicated with a tendency to phthisis. It is usually connected with anæmia and malnutrition, which may be dependent upon a malarial, strumous, or syphilitic cachexia.

Other pains affecting the extremities may be dependent upon acute inflammation from various causes, or they may be rheumatic. When they affect the joints, they are of a gnawing or aching nature, increased by movement. The so-called muscular rheumatism is really a neuralgic affection of the muscles, and properly called myalgia. Whenever muscular contraction is excited, a severe cramp-like pain is referred to the affected muscle or group of muscles. Local inflammation is excluded by the absence of continuous pain, swelling, or redness, and of fever, with other constitutional symptoms.

Symptoms relating to Cough.—There are numerous varieties of cough, some of which have considerable diagnostic significance. The immediate cause of cough is the presence of an irritant, mechanical or sympathetic, affecting the surface of the air-tubes or the nerves that supply them; and it is the object of the cough to remove this source of irritation. The sensibility of the respiratory surfaces is greatest at the commencement, the glottis being an ever-faithful janitor. It may be increased by congestion or inflammation, or by the continued act of coughing. Even the mere inhalation of cool or dry air may, in asthma or bronchial congestion, be sufficient to excite cough. The result of the irritation is to increase the natural secretion and to alter its character. As the pulmonary mucous membrane which protects the larynx and trachea as far as its bifurcation is more sensitive than that which lines the bronchi, cough is usually referred to the throat. When blood is expectorated, it is first perceived when it comes in contact with the lining of the trachea, and for similar reasons patients usually believe that it must proceed from the same locality.

But cough may be due to numerous reflex causes, such as gastric irritation, ear disorder, or aneurismal or other pressure on the vagus, recurrent, or sympathetic nerves. The act may also be caused by a long uvula or enlarged tonsil, a granular state of the pharyngeal or laryngeal mucous membrane, polypi or other foreign bodies in the larynx, trachea, or even in the external auditory meatus. It may be caused by various affections of the bronchial tubes, lungs, or pleura. Cough, therefore, is not a disease to be treated, but a symptom to be traced to its source. An inspection of the pharynx and larynx, and a physical examination of the chest, will generally suffice to detect the cause. The character of the cough is often quite pathognomonic. Thus we have the "whoop" of pertussis, the "bark" of hysteria, the catching, painful cough of pleurisy, the slight "hack" of early phthisis, and the equally distinctive cough of advanced phthisis with laryngeal ulceration, the loud, clanging cough due to pressure on the trachea or laryngeal nerves, the spasmodic, suffocative cough of asthma. The "tightness" or looseness of cough, indicating the absence or presence of secretion, is a valuable guide in diagnosis and treatment. A continuous cough with varying expectoration is common in all diseases of the respiratory organs.

A few short, slight coughs every morning, with a scanty mucous expectoration, or a short, dry cough, often called a hacking cough, is a frequent symptom of the incipient stage of phthisis. It is of much diagnostic importance if

it follow hæmoptysis, or if it be associated with increase of temperature of the body and loss in weight. It is usually a symptom in pleurisy, either acute or chronic. It is an occasional symptom in chronic pharyngitis. Elongation of the uvula sometimes occasions it. It is a rare effect of a local irritation situated elsewhere than in the respiratory organs—for example, the irritation caused by worms in the alimentary canal.

"Cough is short, dry, and evidently suppressed, in the first stage of acute pleurisy. It is called a suppressed cough. The suppression is instinctive, and is caused by the pain attending the acts of coughing. A suppressed cough is also a symptom in cases of pneumonia, also in intercostal neuralgia and pleurodynia. If there be cough in cases of acute pericarditis and peritonitis, it may be suppressed for the same reason. Coughing may frequently be suppressed by a strong effort of the will. Cough is spasmodic or convulsive when it consists of a series of involuntary expiratory efforts, more or less violent, occurring in rapid succession. A typical cough of this variety characterizes pertussis, or whooping-cough. The inspiration succeeding the series of expiratory efforts is accompanied by the whoop, showing spasm of the glottis. The acts of coughing occur in paroxysms, and often occasion vomiting.

"Violent coughing, not spasmodic or convulsive, is caused by the presence of tenacious sputa in the air-passages, and by the delusive sensation of their presence in bronchial inflammation. If the larynx be unaffected, the cough, in proportion to its violence, is sonorous and ringing, from the approximation of the vocal cords. Such a cough suffices to exclude laryngeal affections. The cough is hoarse, husky, or stridulous in laryngitis, either acute, subacute, or chronic. A very slight degree of laryngeal inflammation renders the cough hoarse or husky. In laryngitis with false membrane, and in simple acute laryngitis with submucous infiltration, cough is almost without sound. An abrupt, loud, metallic tone, either high or low in pitch, distinguishes what is known as a croup-cough. Its character is so distinctive that, when once heard, it is easy to recognize it. It characterizes especially the paroxysms of laryngeal spasm, or of so-called false croup to which children are subject—an affection giving rise to needless alarm in the household from the dread of *laryngitis with false membrane*, or the so-called true croup. The two affections are pathologically distinct, and the former does not eventuate in the latter. In the early part of true croup the croup-cough may occur, but it soon gives place to one of a husky character, and, when it is a symptom of this affection, it is associated with other symptoms showing laryngeal inflammation. This croup-cough also occurs in simple acute or subacute laryngitis —that is, without false membrane—in children. Somewhat analogous to the preceding is a variety which is known as a *nervous cough*. This has a short, high-pitched intonation, resembling the crowing of a cock or the cry of some animal; and it is sometimes a low, explosive sound, like the barking of a dog. Its unusual character attracts attention and renders it a source of annoyance to the patient and to others. It occurs almost exclusively in young girls, and, from its being frequently associated with manifestations of hysteria, it has been called a '*hysterical cough*.' From its frequency and persistency it is apt to occasion needless anxiety. It denotes neuropathic disorder, and ceases when the condition of the nervous system is improved. Its purely nervous character is to be determined by exploring the larynx by means of the laryngoscope, with a negative result, and by the absence of other symptoms and the signs of pulmonary disease. Co-existent hysterical manifestations corroborate the diagnosis; but these are not uniformly present. This variety of cough has been known to be so generally diffused by imitation through a girls' boarding-school that the school was in consequence broken up. A feeble, hollow, ineffectual cough is characteristic of the advanced stage of phthisis. To this variety is sometimes applied the significant name *sepulchral cough*. Diseases or injuries of the spinal cord producing incomplete paralysis of the costal muscles, or the diaphragm, or of both, render the cough feeble and ineffectual in proportion to the degree of p

sis. Death under these circumstances may be caused by an accumulation of bronchial secretion which the patient is unable to expectorate. The same result may occur from pulmonary diseases associated with great exhaustion, and as a result of the use of opium, which blunts the sensibility of the bronchial mucous membrane, or rather of the nerve-centers, which excite cough, and especially with patients at the extremes of life."

In conclusion, it should be stated, with regard to pulmonary disease, that the *absence of cough* is no proof of the absence of serious lesion; for while the presence of a few granulations in the lungs is often productive of incessant and uncontrollable cough, long-continued and destructive disease may exist without it.

Symptoms from Expectoration.—The term expectoration is used to signify the expectorating act and the matter expectorated. Using it now in the latter sense, there are numerous varieties of expectoration, having more or less diagnostic importance. The *quantity* of the sputum varies in acute as well as in chronic diseases of the respiratory organs. Sometimes *in the course of severe acute disease*, as senile pneumonia, there is *no sputum*, and in chronic disease also it may be wanting. Children commonly swallow their expectoration. When, in bronchitis, pneumonia, or whooping-cough, the *sputum becomes more copious*, more easy of discharge, and yellowish, *it comes chiefly from the larger bronchi*, and indicates that the smaller tubes are getting clear and the disease subsiding.

The varieties of expectoration most frequently met with are the mucous, the purulent, and the muco-purulent. The first variety is transparent, viscid, and stringy. It has these characters in the first stage of bronchitis and in laryngo-tracheitis. In the second stage it is more abundant, becomes opaque, and is less adhesive, and hence it is expectorated with greater facility. These changes are chiefly due to the presence of leucocytes or pus in larger proportion. The expectoration is now muco-purulent. In *chronic bronchitis* this is most abundant on rising of mornings. A muco-purulent expectoration is said to be nummular when the sputa are flattened and round, resembling a piece of money. Sputa presenting this appearance have been considered as characteristic of phthisis. They are not, however, pathognomonic of this disease. The expectoration is purulent when it consists chiefly or entirely of pus. It is opaque and either of a white, greenish, or yellowish color, devoid of air-bubbles present in mucous expectoration, and therefore sinks in water—a criterion of pus as distinguished from mucus which dates from Hippocrates. An expectoration in which the character of pus greatly predominates occurs in some cases of chronic bronchitis. It presents the characters of pure pus in cases of abscess of the lung, or empyema in which perforation of the pleura has taken place, and when purulent collections of the liver, kidneys, spleen, or in other situations, are evacuated through the bronchial tubes. Whenever pus is expectorated suddenly in considerable quantities, it is derived from one of these sources.

A serous expectoration is a thin liquid, more or less abundant, and devoid of the appearances derived from either pus or mucus, though it may be more or less mixed with either, and is then called muco-serous or seropurulent. A serous expectoration is expressed by the term bronchorrhœa. The liquid is a transudation into the bronchial tubes. When collected in a vessel, it has a foamy appearance, and is sometimes sanguinolent. This expectoration is a marked symptom in some cases of œdema of the lungs, occurring in this connection without bronchitis. It characterizes certain cases of bronchitis associated with obstructive lesions at the mitral orifice of the heart. But it occurs when, aside from bronchitis, no special causation is apparent.

False membrane, formed in the larynx and trachea, is expectorated in patches varying in size and shape. This is characteristic of exudative laryngitis or true croup, either occurring as a distinct affection or as a complication of diphtheria. It is expectorated if the disease does not destroy life ... its separation from the mucous membrane takes place. Sometimes

the expectoration of this character is of a cylindrical form, corresponding to the caliber of the tubes from which they are detached.

"Calcareous concretions may be contained in mucous or muco-purulent sputa, or they may be expectorated by themselves. They vary in size from that of a pin-head to a pea, and are either round or irregular in shape. They correspond to calculi found in the lung-tissue or in pulmonary cavities after death. They have been considered as tubercles which have undergone calcification—in this way becoming obsolete. They are to be distinguished from the concretions which not infrequently are found in the follicles of the tonsils, which are sometimes expelled by acts of coughing, and may be known by their unctuous feel, crushing instead of crumbling under pressure, and generally, when crushed, emitting an offensive odor. They may be further distinguished by an inspection of the fauces, which usually shows similar masses remaining in the follicles.

"A microscopical examination of purulent or muco-purulent sputa in cases of phthisis may reveal the presence of elastic fibers from the lung-tissue. This is evidence of destruction of pulmonary substance in the progress of this disease, and it may be available before the physical signs of cavities are determinable. By the addition of acetic acid the sputa may be rendered transparent, and the elastic tissue is then, if present, more certainly detected; but, practically, the experienced eye is the best guide in the selection of those small pin-head flocculi of expectoration in which the microscopical particles of lung-tissue are to be detected. The following points illustrate the most important diagnostic aid afforded by the expectoration in lung complaints of ordinary occurrence: If a person with a severe chest complaint coughs frequently and spits only frothy salivary fluid, we may suspect pleurisy. If the fluid is glairy, like the white of an egg, we may suspect acute bronchitis. If it has a rusty tinge and resembles thick gum-water colored with blood, we are not likely to err in recording pneumonia. If there is a sudden gush of fetid pus, we may diagnose abscess in the lung, or an empyema. Purulent expectoration may occur in bronchitis as well as in phthisis; but, if long continued and unaccompanied by a distinct rhonchus, it almost always comes from a vomica. In phthisis the sputum is at first salivary or frothy, the result of irritation, then viscous, indicative of more confirmed affection of the mucous membrane, and subsequently dotted and streaked with blood. Whitish opaque spots, giving a pearly aspect to the expectoration, next appear; these enlarge, become flocculent, and ultimately nummular, being inspissated and molded in a cavity. As the disease advances and involves both lungs, the expectoration is entirely purulent, and, shortly before death, is often surrounded by a pinkish or blackish halo. There are several varieties of expectoration containing blood which are not exclusively hæmorrhagic. One is the rusty expectoration referred to which is pathognomonic of pneumonia. This expectoration is semi-transparent and adhesive, the rusty color being due to the intimate admixture of a little blood. Owing to its viscidity, a considerable quantity will remain at the bottom of the vessel when inverted. This variety of expectoration is not to be confounded with that to which the name prune-juice has been applied. The prune-juice expectoration contains blood in larger quantity intimately mixed. The sputum is less viscid. It occurs in pneumonia, but usually at a later period than the rusty expectoration. An expectoration presenting bloody streaks is characteristic of bronchitis in its first stage. The streaks are caused by sputa passing over points where a few drops of blood had escaped. The blood is sometimes in points and dots instead of streaks."

After hæmoptysis has ceased, the sputa frequently, for some hours or days, are more or less bloody—that is, they contain blood mixed in variable proportions. The blood has a dark color.

An intimate admixture of blood with sputa of a jelly-like consistence occurs in some cases of carcinoma of the lung. This has been called the currant-jelly expectoration. It is somewhat diagnostic of this affection.

The sputa in some cases of pneumonia are yellow and sometimes green-

ish. These appearances were formerly attributed to bile, but are caused by hæmatin, which, in combination with mucus, may undergo these changes in color. Bile has, however, been discovered in the expectoration of pneumonia by chemical reagents when the disease is associated with intense jaundice; but its presence is exceptional and of grave import. In most cases of disease the expectoration is devoid of any distinctive odor. In pulmonary gangrene, however, the odor is an essential element in the diagnosis. An intense and characteristic fetor is caused by the presence in the expectoration of the decomposed pulmonary tissue. The expired breath has the same fetor, while the expectoration presents a dark, dirty appearance, which is suggestive of sphacelated matter.

Significance of Nausea and Vomiting.—Nausea is a desire to vomit. It may arise from merely nervous disorder, from sympathy of the stomach with some other organ, or from disease of the stomach itself. It has no particular significance in disease except as a precursor of vomiting. It is, however, one of the earliest and most constant signs of pregnancy.

Vomiting may be symptomatic of a local affection of the stomach or of disorder in some other part of the system. Its simplest form is that excited by the presence of undigested food in the stomach. It is then preceded by loathing, nausea, chilliness, watering of the mouth, paleness, coldness of the extremities, and a slow, small pulse. Heaving of the abdomen then takes place, and, by the concurrence of the muscles of its parietes—those of the stomach and the diaphragm—the contents of the stomach are ejected. A marked sense of relief follows this operation, the pulse becoming fuller and softer, and the skin warm and moist. But, when vomiting is excited by any other cause than that just mentioned, the evacuation of the stomach is not followed by so great relief—as when the mucous lining of this organ has been directly irritated or is inflamed, or when the sympathetic cause is permanent, as in pregnancy. It is then painful or exhausting, often exciting cramps in the stomach, or, as in peritonitis, producing the most intolerable suffering. In most acute diseases it occurs but once or twice, and that at the period of invasion; in others—such as cholera morbus, peritonitis, hernia, etc.—it may continue throughout the attack. Children vomit more easily than adults; old persons rarely do so spontaneously, and always with much suffering and great risk of rupturing the heart and arteries. The causes of vomiting are local, reflex, and those arising from morbid conditions of the blood. Some notion of the nature of a gastric disorder may be derived from the tolerance or rejection of certain kinds of food and medicine. Those of a stimulant and tonic character never fail to aggravate vomiting produced by inflammation of the stomach, while they usually allay this symptom if it depends upon nervous derangement. If vomiting take place immediately after eating, it may either indicate ulceration, chronic gastritis, or cancer, especially if it be accompanied by pain. It is important to ascertain the quality of the matters vomited, for they vary with the morbid condition present. In the stage of invasion of most acute diseases they consist of more or less perfectly digested *food;* in pregnancy and gastralgia, *mucus;* in Asiatic cholera, of a *serous* fluid containing white flocculi; in remittent fever, hepatitis, and protracted dyspepsia, and in most cases where the act of vomiting is accompanied by severe straining, *bile* is a prominent constituent; while *stercoraceous* matter may be present in the matters vomited in strangulated hernia, intussusception, and other obstructions of the intestine; *pus,* when an abscess (usually of the liver) opens into the stomach. Sometimes a matter resembling *coffee-grounds,* and which is most probably blood which has been acted upon by the acids of the stomach, is observed among the matters vomited in cancer of the stomach when the cancerous deposit is formed near the pylorus and its inner surface has become ulcerated. This substance is also very generally vomited in fatal cases of yellow fever. And, finally, substances which have been swallowed and act as irritants, and otherwise excite vomiting, such as the acrid and narcotic poisons, are to be noted. The matters vomited in any case where the cause of the attack is obscure should

always be preserved for examination, for they may lead to the discovery of a suicidal intention on the part of the patient, or of a felonious intent on that of some concealed enemy.

Significance of Chill or Rigor.—This state is characterized by the following phenomena: There is general shivering, the tremulous movements not infrequently being so great as to cause chattering of the teeth. The face wears an anxious expression of great discomfort, or even distress. The complexion, especially on the lips and beneath the nails, is blue and livid. The tongue is moist, although thirst is felt. The fingers are shriveled and "dead," the skin dry and corrugated, and the cutaneous sensibility diminished. The respiration is quickened and shallow. The pulse is frequent, small, and firm. The temperature of the general surface is raised, although a sensation of cold—sometimes of severe cold—often referred to the back or the abdomen, is present. The extremities, however—as the fingers, ears, and nose—may be colder than natural. With these may be combined other symptoms, such as headache, nausea, vomiting, and the special pains in the back or limbs which are proper to the different species of fever; but delirium is rarely present.

Rigors are the result of the disturbance of some as yet undetermined nervous tract, which, however, is clearly connected with, if not in fact the same as, the great co-ordinating center in the medulla oblongata for the respiratory, cardiac, and vascular movements. The effect of the impression thus made results in a vaso-motor disturbance of the peripheral circulation, which brings about an abnormal difference between the temperature of the surface and that of the interior of the body. It is for this reason that a patient, already in the grasp of a serious disorder, the temperature of whose body is raised and is rapidly rising, has yet the same sensation of cold as a healthy individual whose external temperature is below the normal, and whose nervous and vascular systems are merely reacting in a perfectly natural manner under one of the commonest conditions of animal life, for in each case the surface is colder than the deeper parts, and thus gives rise to a sensation of cold. And this will explain why great internal heat of the body may create the sensation of great external cold, although the temperature of the body, as a whole, may mark hyperpyrexic degrees. And thus is established, on a scientific basis, the empirical belief in the value of rigors as marking the access of disease, when it is seen that their presence is a proof that increased tissue-change, as shown by the increased production of heat—the very essence of fever—has already begun. The early diagnosis of fevers, whether idiopathic or symptomatic, is often greatly facilitated by the careful study of the phenomena of the initial rigors. Putting on one side the cases in which a local cause may be found to exist, very violent rigors occur chiefly in connection with the following diseases: Malarial fevers, relapsing fever, variola, scarlatina, erysipelas, pyæmia, and croupous pneumonia. They are less marked in typhus and enteric fever, pleurisy, catarrhal pneumonia, and bronchitis. It must, however, be remembered that, in appraising the value of any nervous symptom, such as rigors, the personal factor is of extreme importance, and that general rules derived from averages are here, more than ever, misleading, if applied indiscriminately to individuals.

In conclusion, it may be stated that rigors occur under the following morbid conditions: 1. At the beginning of idiopathic and symptomatic fevers—that is, when the fever has already begun, and the increased heat-production in the viscera has destroyed the natural balance between the temperature of the interior and of the surface of the body. 2. With the access of the exacerbation of some local disease, especially if it be one which is to end in the formation of pus. Rigors occur not only at the beginning, but also during the progress, and with great violence just before the bursting, of an abscess. Thrombosis of the veins is also attended with rigors. 3. From irritation of a sensory nerve, and especially in connection with some mucous surface. Thus rigors are an every-day result of the presence of irritating matters in the stomach and bowels, of catheterism, and of the passage of biliary or

renal calculi. 4. They may occur from purely nervous causes, as sudden shock, nervous exhaustion, and mental emotion.

Although for practical purposes it is convenient to distinguish these different modes of origin of rigors, they are essentially identical—that is, in each we have the effect of irritation of a certain kind conveyed by different nerves to the central nerve-tracts or ganglia, which results in vaso-motor disturbance. A chill or rigor occurring in the course of a disease which is not paroxysmal is generally an indication of an inter-current inflammation, or of suppuration in a part already inflamed, and is, therefore, of evil augury. Thus, in the progress of continued fevers, such an occurrence renders it probable that an attack of pneumonia, pleurisy, pericarditis, endocarditis, or meningeal inflammation is about to take place. During the decline of typhoid fever a severe chill is usually accompanied with abdominal pain, and is then a sign of peritonitis from perforation; in the puerperal state this phenomenon may accompany the establishment of the lacteal secretion, or, if the abdomen become tender at the same time, metro-peritonitis may be anticipated; at a somewhat later epoch it is more likely to threaten an attack of phlegmasia dolens, or the formation of an abscess in the breasts. After wounds, a rigor may precede the appearance of erysipelas, phlebitis, the formation of purulent deposits in the lungs, liver, or other localities. In the course of parenchymatous inflammations a chill denotes the advent of suppuration. This is seen in simple phlegmon and in pneumonia. The daily recurrence of a slight chill, followed by fever and sweat, when it takes place in chronic affections marked by debility and wasting, is called *hectic* fever. And in case of organic disease it shows, as a rule, that the fatal issue of the attack is approaching. It does not, however, follow that hectic chills are always a fatal omen. They may occur in chronic bronchitis, in empyema, and in large external suppurations, and yet the patient recover.

Significance of Diarrhœa.—This affection is *symptomatic* in various morbid states. For instance, in passive congestion of the portal vein from disease of the liver, heart, or lungs; peritonitis, especially puerperal; organic disease of the intestines, ulceration (simple, typhoid, tubercular, or cancerous), lardaceous degeneration, enteritis (acute or chronic), cholera, typhoid fever, dysentery; occasionally in pyæmia, measles, scarlatina, confluent small-pox, malaria, gout, the later stages of Bright's disease, and in anæmia and exhaustion, as from over-lactation, indigestion, and nervous disturbances, especially from mental and emotional perturbation, grief, worry, and anxiety, as well as neuralgia and dentition. When diarrhœa attends the commencement of an acute attack of disease seated elsewhere than in the abdomen, it is of unfavorable significance; but if it arise later in the course of the complaint, and is followed by an alleviation of the symptoms, it is sometimes critical. Thus dropsies have been cured by spontaneous diarrhœa; but it is a bad omen when occurring in chronic diseases of any kind and followed by great debility.

When the sphincter ani has lost its power of contracting through disease of the brain or spinal marrow, or through great debility, the fæces are discharged involuntarily; in the one case without the patient's consciousness, and in the other without his being able to prevent it. In acute diseases this symptom indicates almost certainly a fatal result; but in chronic affections, idiocy, and dementia, it involves no peculiar danger.

There is no question about the beneficial effects of diarrhœa in morbid conditions of the system dependent upon blood contamination from bad food, bad water, and impure air, the increased activity of the intestinal canal being one of nature's best methods of getting rid of *materies morbi* within the system. In this way eliminating "waste" material, diarrhœa is often vicarious in relation to other important functions.

Thus, for example, embarrassment or suppression of the functions of the skin, kidney, or lungs may be met by the bowels performing additional excretory work. The flux thus set up is salutary, because it is compensatory. Diarrhœa from chills (suppressed perspiration) is a common instance, while

hat from renal and pulmonary disease is less frequently observed, and may be misconstrued by the practitioner. Inasmuch as diarrhœa usually diminshes the quantity of urine, even sometimes to the verge of suppression, when the urine is free from albumen it is often difficult to determine whether the diarrhœa is a cause or an effect of imperfect renal elimination—a distinction having all-important bearings on the treatment. The uræmic and eliminatory character of it may be easily decided when the kidneys are known to be diseased. Not so, however, when the only thing ascertainable is scanty —may-be albuminous—urine, or total suppression of urine, in an elderly patient. In such a case there may or may not be organic disease of the kidneys, and still the diarrhœa be uræmic, inasmuch as it may depend upon "*renal inadequacy*." Diarrhœa from pulmonary embarrassment generally affords relief to breathing and cough.

Significance of Jaundice.—This morbid condition is not a disease, but in reality a symptom of many different diseases, and our efforts in every case must be directed to the discovery of the fundamental malady upon which it depends. Two main causes of jaundice are now recognized—the one dependent upon a mechanical obstruction of the bile-duct, called *hepatogenous* jaundice; the other due to incomplete or deficient metamorphosis of bile after it is absorbed into the blood, and known as *hæmatogenous* jaundice. It is always important to note the mode of commencement of jaundice. That which appears suddenly in a person whose previous health has been good is most probably the result of obstruction of the duct by a foreign body, though it may have a nervous origin. The former cause will be distinguished by biliary colic, vomiting, and clay-colored stools. On the other hand, jaundice coming on slowly, but ultimately becoming intense, with clay-colored stools, points to pressure on the duct from without or to a growth in its interior. A history of previous attacks of jaundice of a similar nature is in favor of catarrhal origin or of gall-stones. Pain in severe paroxysms concurring with jaundice points generally to gall-stones or cancer. Cancer is distinguished from gall-stones by there being usually a history of failing health and emaciation before either the pain or jaundice. Jaundice concurring with enlargement of the liver is most probably due to cancer or cirrhosis; more rarely to pyæmic abscesses. Jaundice concurring with ascites points to cancer or cirrhosis. The diagnosis of the latter will usually be assisted by the physiognomy, the slightness of the jaundice, the previous habits, and a history of alcoholic dyspepsia; while in cancer there are often darting pains, and the jaundice is usually intense. Jaundice in young persons, preceded by symptoms of gastric catarrh, is most probably catarrhal. The symptoms referred to are usually loss of appetite, nausea or vomiting, tenderness over the epigastrium and duodenum, and some febrile movement.

The presence of jaundice independent of mechanical obstruction of the bile-duct points to the presence of poisons in the blood interfering with the *normal metamorphosis of bile*, such as the poisons of the various specific fevers, pyæmia, and snake-bites. Severe mental emotions, fright, anxiety and grief, deficient oxygenation of the blood, and undue absorption of bile, either from its excessive secretion or from habitual or protracted constipation, also develop *hæmatogenous* jaundice; but in all these cases it does not of itself unfavorably influence the prognosis of disease, except that a marked impoverishment of the blood, from diminution in the proportion of red corpuscles and fibrin, takes place, giving rise to a tendency to hæmorrhage and more protracted convalescence.

Significance of Coma.—This term denotes a state of unconsciousness from which the patient either can not be roused or is roused with great difficulty. It is a symptom occurring in many of the affections of the brain, such as the different varieties of meningitis, cerebral and meningeal hæmorrhage, dropsical effusion, abscess, arterial embolism, and thrombosis. In all of these different affections the immediate pathological causation is probably an interruption of a proper supply of oxygenated blood to the capillaries, depe on either compression of the brain-substance or obstruction of the sup

arteries. Coma is also an element in certain functional affections of the nervous system. It occurs in epilepsy, hysteria, and catalepsy. In determining that it is symptomatic of some one of the cerebral diseases, other affections and certain toxical agencies are to be excluded. Thus it occurs in uræmia, the essential fevers, cholesteræmia, and it may be due to excessive heat, to narcotism, and to alcoholic intoxication, or to long-continued exposure to cold. The dependence of coma upon such opposite conditions of the economy imposes upon the practitioner the duty of ascertaining its origin and complications in each particular case. "A patient in the state of coma may be seen by the physician for the first time, and it may be highly important to determine without delay, if possible, which one of these several conditions exists. The diagnosis must, of course, be based exclusively on objective symptoms. The following circumstances will generally aid him materially in forming his diagnosis and prognosis: It is important to ascertain whether the attack occurred suddenly or came on more or less slowly. The latter is apt to be the case when it is symptomatic of alcoholic intoxication, narcotism, and hysteria. In all cases the head should be examined for traumatic causes, as the slow effusion of blood may give rise to coma some time after the original injury. A diagnostic feature of narcotic coma is the diminished frequency of the respiration, contracted pupils, cool and often perspirable skin. In alcoholic coma vomiting usually takes place which may emit the odor of wine or spirits, or it can almost always be perceived in the breath by the smell. The pupils are dilated in contrast to their appearance in narcotic poisoning, and the temperature of the body is below the normal range. Hysterical coma is rarely complete; the previous history will generally show that coma was preceded by some of the well-known manifestations of hysteria. The appearance is that of quiet sleep. The pupils respond to light, the pulse is regular, and the cold douche applied to the head rarely fails to restore consciousness. In coma from epilepsy the evidences of convulsions are to be sought after in the presence of frothy saliva, perhaps colored with blood, and wounds inflicted by the teeth upon the tongue. The absence of hemiplegia is to be noted, and uræmia is to be excluded by examining the urine. Coma from embolism and cerebral hæmorrhage is often sudden, while that from thrombosis takes place more gradually. The most common cause of very profound coma is cerebral hæmorrhage (apoplexy). In this condition the breathing is often loud and stertorous and consciousness is entirely obliterated, so that there is an utter absence of reflex movements when a limb is pinched or when the conjunctiva is touched." The patient in the deeper forms of coma often can not be roused at all, even for a moment; and if this state does not terminate in one way or another before the expiration of twenty-four hours, or if it does not gradually pass into one of mere stupor, a fatal result may be considered imminent.

Significance of Ascites.—By the term *ascites* is meant an accumulation of fluid within the cavity of the peritonæum more or less serous in character. The chief clinical import of ascites is to point out the morbid conditions by which it may be produced, as it almost always follows and is a consequence of certain pre-existing organic diseases. The causes to which this important symptomatic condition may be attributed are enumerated as follows: 1. Direct mechanical obstruction affecting the portal circulation. 2. Cardiac or pulmonary diseases obstructing the general venous circulation. 3. Diseases of the kidneys. 4. Morbid conditions of the peritonæum. 5. Miscellaneous causes, such as the sudden suppression of habitual discharges and extreme anæmia and debility.

A proper interpretation of the respective morbid conditions which may be the cause of this symptom requires that all the facts bearing upon the case must be taken into account and carefully weighed, special attention being paid to the liver and the structures in its vicinity, to the heart, and to the kidneys. The amount of the ascites and its relation to other forms of dropsy afford considerable aid in the diagnosis. If it results from cardiac or renal disease, ascites always follows dropsy in some other part of the body, to which

it is also generally subordinate; when it is due to hepatic or some neighboring disease obstructing the portal circulation, the peritoneal dropsy appears first, and is throughout most prominent. Should the vena cava inferior be obstructed at its upper part, anasarca of the legs will be observed simultaneously with, or even before, the ascites. When ascites is due to chronic peritonitis, the disease is generally associated with either cancer or tubercles; and if with the latter, the symptoms and signs of pulmonary phthisis will be manifest. In the great majority of cases of ascites it is associated with cirrhosis of the liver and with certain habits of the patient in regard to drinking spirits, such as taking them more or less largely and habitually on an empty stomach. Occasionally it accompanies syphilitic and other forms of contracted and indurated liver, or it may be associated with infiltrated cancer. Ascites does not often accompany renal disease to any great extent; the amount of effusion in such cases is small, and but a subsidiary part of a general dropsy. The prognostic significance of ascites will mainly depend upon its cause, the amount of the fluid present, the state of the patient, the condition of the main organs, and the results of treatment. In some cases this symptom is in itself attended with immediate danger on account of the mechanical effects of the dropsical accumulation, especially upon the thoracic organs, and still more if those organs are in a diseased condition. In other instances it aids in reducing a patient and in thus bringing about a fatal termination.

Hæmorrhage from various organs often affords valuable information respecting disease. Idiopathic *epistaxis*, or bleeding from the nose, is of symptomatic importance. It frequently occurs in children, particularly boys, just before or about the age of puberty, and in girls as a form of vicarious menstruation. It may be one of the forms of bleeding in persons of the hæmorrhagic diathesis, in which case it is a source of anxiety and difficulty. Occurring in advanced life, it may be indicative of overdistention or obstruction of the cerebral venous system from chronic Bright's or cardiac disease, and the blood which flows is then often venous in appearance. In other instances, epistaxis is connected with serious disorder of the blood, as in the specific fevers. Thus it is often associated from the outset with remittent, enteric, typhus, or scarlet fever, and, in fact, is regarded in some degree as pathognomonic of enteric fever. It may also attend scurvy, purpura, hæmorrhagica, splenic disease, pyæmia, and erysipelas, being a sequence of the septic condition. In its passive form, epistaxis is often associated with organic disease of the heart, pleurisy, emphysema, ascites, or ovarian dropsy, on account of pressure on the diaphragm inducing a stasis of the venous circulation. Epistaxis must not be confounded with hæmoptysis, as may happen when the former takes place posteriorly and the blood passes into the mouth.

Hæmoptysis, or expectoration of blood from the lungs, is a symptom of much diagnostic value in phthisis. Before pulmonary cavities have formed in this disease, the hæmorrhage is from the bronchial mucous membrane. In the cavernous stage it may form from the interior of the cavities by peri-vascular tuberculosis; but it occurs much oftener in an early period of the disease than when it has considerably progressed, so that it is valuable as a diagnostic symptom at a time when it is not always easy to diagnosticate the disease by other symptoms or by physical signs. It not infrequently precedes other pulmonary symptoms, and sometimes even appreciable signs. So frequent is its occurrence in phthisis, and so infrequent, comparatively, in other diseases, that, whenever preceded or accompanied by cough, it is presumptive evidence that either the patient is, or is likely to become, phthisical. Hæmoptysis is a symptom in cases of hæmorrhagic infarctus and pulmonary apoplexy, in stenosis of the mitral orifice of the heart, in some cases of dilatation of the bronchial tubes, and in emphysema. In those affections, with the exception of pulmonary apoplexy, it is usually small. Bronchial hæmorrhage may be vicarious with menstruation, although instances are rare. It may occur in cases of purpura, scorbutus, and yellow fever. It may proceed from the bursting of an aneurism into the trachea or one of the primary bronchi.

It is an occasional event in pregnancy, and when no other symptoms of pulmonary disease are present; and, finally, it may occur spontaneously, being neither a symptom of any disease that can be recognized, nor a premonition of any disease: such cases, however, are rare. The blood is usually expectorated by slight efforts of coughing. It flows upward into the trachea, and is easily expelled. To determine that it comes from the air-passages is important. Hæmorrhage from the posterior nares, throat, mouth, and the stomach is to be distinguished from hæmoptysis. It is extremely rare for blood to come from the posterior nares without appearing at the nostrils—that is, with epistaxis. Inspection of the throat and mouth will discover its source in these situations. The only real difficulty is in deciding between hæmoptysis and hæmatemesis. This is rarely difficult if the blood be seen. In hæmatemesis it is ejected by acts of vomiting, the color is usually dark or black, it has a sour odor, and it does not contain air-bubbles. Blood from the air-passages has usually a bright color. It acquires, however, a dark color if it remain for some time in the air-passages before being expectorated. It is usually spumous, or frothy; an exception to this statement is when it is expelled very rapidly. If the patient be seen while the hæmorrhage is occurring it is easy to determine whether the blood is expelled by acts of coughing or vomiting. Genuine hæmoptysis can rarely be mistaken by a skilled observer present at the attack. The gurgling in the bronchi, the loose cough, and repeated expectoration of *bright, frothy blood* are quite characteristic. The quantity of blood brought up in hæmoptysis varies from a mere streak to a quantity that may prove instantly fatal. In decided hæmoptysis the shock to the system is always great; the patient is alarmed and anxious, especially on the first attack. The sense of weakness and prostration is, in fact, often prolonged after the attack has ceased, which may be but slight as regards the quantity of blood lost. It has been clearly shown that the inhalation of blood into the bronchial tubes and pulmonary alveoli sometimes sets up broncho-pneumonia, and thus may give rise to fresh centers of phthisical disease.

Hæmatemesis is a term which signifies vomiting of blood, and is a symptom dependent upon a variety of morbid conditions; but the most frequent is an *ulcer* of the stomach. It occurs in about one third of all cases of gastric ulcer that come under treatment. The bleeding usually takes place shortly after a meal, and the quantity ejected varies greatly. In some cases it is so small that it may require careful examination to discover it, while in others enormous quantities are vomited, and often also passed through the bowels. It is not necessary that the ulcer should be of large size to produce the hæmorrhage. In *cancer* of the stomach profuse hæmorrhage is less common than in simple ulcer, the larger vessels probably being compressed by the new growth which ordinarily commences in the submucous tissue above them. But a constant oozing of blood, on the contrary, is more common than in simple ulceration. This blood, acted on by the gastric juice, constitutes the *coffee-grounds* vomiting of the older authors. Its occurrence was formerly looked upon as pathognomonic of malignant disease; but it is now known that its presence only shows that the bleeding has taken place slowly and in small quantities at a time. Occasionally profuse hæmorrhage takes place from a rupture of an *aneurism* into the stomach. *Congestion of the portal system* is a very frequent cause of hæmatemesis, especially that which results from cirrhosis, chronic congestion, and other diseases of the liver. It may also arise from diseased heart, especially where there is narrowing of the mitral orifice. In such cases there is generally a co-existing chronic catarrhal gastritis, and, in all probability, the bleeding takes place from hæmorrhagic erosions so common in that condition. Hæmatemesis due to acute congestion is also a constant result of irritant poisoning. Hæmatemesis also arises from diseases affecting the blood and predisposing it to ooze through the walls of the veins and capillaries. It occurs in this way in purpura, yellow fever, and in some cases of typhus. In some rare instances it appears to be supplementary to menstruation, and is sometimes incident to pregnancy. The

author has observed it in one or two cases of severe labor, and, in fact, it may occur irrespective of pathological lesions, when it is to be considered as purely functional and idiopathic; in other words, it is neither preceded, accompanied, nor followed by disease of the stomach or elsewhere. Several cases of this character have been noted by Fenwick, Flint, and other clinical observers. The prognosis of hæmatemesis, as a general rule, is favorable, more especially in first attacks. The mortality from gastric ulcer, or from hepatic congestion, or cirrhosis, does not exceed five per cent. Still, the possibility of the bleeding arising from the opening of a large artery or from the bursting of an aneurism should be kept in view and the patient carefully watched.

Entorrhagia, or an escape of blood from the intestines, is a symptom of morbid conditions rather than an actual disease itself, and hence the cause of the hæmorrhage must be sought for. In gastric hæmorrhage a portion, and sometimes all the blood which escapes into the stomach, may pass into the bowels; but its visible characters are mostly lost from the changes which take place during the passage through the intestinal canal, and the dejections have a dark, tar-like appearance. More or less of the same changes take place if the hæmorrhage be in the upper part of the small intestine, especially if the quantity which escapes be not large. In proportion as the blood passed from the bowels is but little changed, the inference is that the source of the hæmorrhage is not far from the outlet. Blood wholly unchanged is from the lower part of the rectum. Hæmorrhage in this situation is of frequent occurrence; from hæmorrhoids and fissures it is rarely copious. It follows straining at stool, and is generally accompanied by symptoms denoting disease of the rectum. Exclusive of rectal affections, hæmorrhage from the bowels proceeds from a variety of causes. In rare instances it is the result of an aneurism which has burst into the intestinal canal. It is a symptom in certain general diseases—namely, purpura, scorbutus, malarial and yellow fevers—and it is the result of primary altered blood-states. It is an untoward accident in some cases of typhoid fever, being incident to the intestinal ulcerations which characterize that disease. It may be caused by dysenteric, tuberculous, and syphilitic ulcerations. It is not an infrequent result of the portal congestion occasioned by cirrhosis of the liver. Embolism of the superior mesenteric artery is another cause. It may occur vicariously as a substitute for menstruation. Intestinal hæmorrhage occurs irrespective of the causes just named, and of any appreciable causation. In these cases it must be considered as an idiopathic affection. The only sources of error in diagnosticating intestinal hæmorrhage are, mistaking for the evidence of blood the dark-colored dejections which follow the administration of iron or bismuth, and the voluntary admixture of blood in the dejections by malingerers.

Prognostic indications of intestinal hæmorrhage are determined by the signs and symptoms of the causal disease and the extent of the hæmorrhage, many bleedings being so trivial as to give rise to no appreciable effects, and in extreme cases the loss may be so great and sudden as to lead to rapid collapse and death. Between these extremes all degrees of anæmia, faintness, pallor, giddiness, and failing pulse may be observed. The amount of blood evacuated is not a sure guide to forming an opinion of the result. It is difficult to estimate the actual quantity lost, since much may be retained in the bowel. The general condition of the patient, especially the state of the pulse, is of far more importance. While allowance must be made for the nature of the cause, occasionally the escape of blood is beneficial. This is particularly the case where the cause is a congestion of the intestinal tract, with or without hæmorrhoids. Thereby the fullness of the bowels is relieved and a more equable circulation is established. In some cases of typhoid fever, contrary to what might be supposed, improvement has been noticed to follow a moderate loss of blood. In many cases where the hæmorrhage cannot be traced to any antecedent morbid condition, the attack will end in recovery.

Metrorrhagia is a term signifying hæmorrhage from the uterus at any other time than the catamenial epoch. When metrorrhagia is present during menstrual life, the catamenia are, as a rule, also profuse. These hæmorrhages are symptomatic of many lesions, and, in fact, accompany the majority of the pathological conditions to which the pelvic organs are liable. They may also arise from general states, as scurvy, the hæmorrhagic diathesis, Bright's disease, phthisis, cirrhosis of the liver, and the acute specific diseases. The most common cases are, however, met with in the form of distinct alterations of structure in the pelvic organs, as subinvolution of the uterus, polypus, fibroid tumor, cancer displacements, retained placenta, moles —fleshy or vesicular—fungous degeneration of the mucous membrane of the uterus, mucous polypi, ulcerations of the cervix, hæmatocele, inversion of the uterus, and congestion of the uterus, due to obstruction to the circulation through the heart and lungs or liver. Profuse hæmorrhages of an irregular character occur also in young girls before the advent of regular menstruation. This form of uterine hæmorrhage is not common, but it is sometimes of very serious import, for occasionally it has proved fatal. More frequent is the occurrence of irregular bleeding from the uterus during the menopause. The cause of these climacteric hæmorrhages are not really known. They have been regarded as symptomatic of congestion, but on insufficient evidence.

Hæmaturia is a term which denotes the presence in the urine of blood in its entirety—that is, including the red corpuscles—and shows that a true hæmorrhage has occurred in the urethra, bladder, ureter, or kidneys. It is among the diagnostic symptoms of several renal affections, and it occurs together with hæmorrhage from other situations, in scorbutus and purpura hæmorrhagica. "When the blood is derived from the urethra, it precedes the stream of urine, sometimes forms a long, thin clot, and it may escape in the intervals of micturition. When it has lain in the bladder and been poured out in considerable quantity, it is often in clots, and, when the urine is voided the first part is frequently clear, the last loaded with blood. When derived from the ureter and pelvis of the kidney, sometimes clots in the form of molds of these structures may be recognized. When derived from the substance of the kidney, the blood is intimately mixed up with the urine, which frequently exhibits bloody tube-casts." Urethral hæmorrhage is due to local inflammation or rupture of vessels. Prostatic hæmorrhage may be due to malignant disease, to tumors, inflammation, or to scrofulous affections of that organ. Vesical hæmorrhage results from malignant disease, inflammation, or irritation from a calculus. Hæmorrhage from the ureters or pelvis of the kidney may be due to the presence of calculi. Hæmorrhage from the kidney may be due to cancer-tubercle or suppurative-nephritis. It may occur in all the forms of Bright's disease, especially in the early stage of the inflammatory form and the advanced stage of the cirrhotic. "*Hæmaturia* must not be confounded with *hæmatinuria*, which is not a true hæmorrhage, the urine being colored by hæmatin excreted by the kidneys. The difference in cases of doubt may be made known by means of the microscope. This coloring material of the blood is often present in the urine in the so-called hæmorrhagic pernicious intermittent fever." This condition of the urine sometimes occurs paroxysmally, independent of malaria, and with no appreciable connection with affections of the kidneys or urinary passages, and with no tendency to a fatal ending.

Paralysis, which signifies a loss of the power of motion in any part of the body, is symptomatic of many morbid conditions. As the contractile power of the muscles depends upon their healthy organization and the integrity of their structure, anything which interferes with these qualities will diminish in a corresponding degree their power of action. Imperfect nutrition or atrophy of the muscles, their disuse from arthritic disease, a fatty degeneration of their texture, and the action of certain poisons—chemical as lead, or specific, as diphtheritic—may have this effect, and destroy the power of motion by directly affecting the muscular fibers themselves. A

paralysis of this kind is called myopathic paralysis, because it resides in the muscular tissue which has lost its natural properties.

"Paralysis is, however, oftener due to disease or injury of the nerves or nerve-centers. Having ascertained the existence of paralysis, together with its degree and extent, the seat of the causative affection is to be ascertained. The affection may be seated in the brain, the spinal cord, or in the course of motor nerves between the points where they originate and the muscles in which they terminate. A paralysis dependent on an affection of the nerves is distinguished as peripheral, the periphery of the nervous system comprising their whole course from the centric connections to their terminations. With reference to seat, therefore, *neuropathic* paralyses are either cerebral, spinal, or peripheral in their origin.

"A cerebral affection is always to be inferred from the existence of paralysis of the upper and the lower limb on one side (*hemiplegia*). The instances are so few as to render it always vastly improbable that an affection of the upper portion of the spinal cord is so localized as to cause paralysis thus limited. The cause is certainly seated in the brain if, with the hemiplegia, the muscles of the face or tongue be paralyzed. It is as improbable that a paralysis limited to the two lower limbs (paraplegia) is cerebral as that hemiplegia is spinal. Hemiplegia is symptomatic of a circumscribed apoplexy, or an injury which affects one side of the brain, and which, owing to the crossing of the fibers in the medulla oblongata, produces paralysis of the opposite side of the body. A general paralysis is rarely of cerebral origin. It may, however, be due to hemiplegia from meningeal or cerebral hæmorrhage and tumors, occurring first on one and afterward on the other side; or a hæmorrhage may take place simultaneously upon or within both hemispheres of the brain, and paralyze at once the four limbs.

"The four limbs may become incompletely paralyzed or paretic in the disease known as progressive general paralysis (dementia paralytica). Whenever general paralysis is caused by intra-cranial lesions, it is associated with cerebral symptoms, by means of which it may be differentiated from general paralysis of spinal origin; and, in most instances, the cerebral source is further shown by paralysis of the face or tongue. Exclusive of the cranial motor nerves, a local paralysis is rarely cerebral. Paralysis of the orbital or facial muscles, or of the tongue, may be either cerebral or peripheral. The differential diagnosis is made by excluding discoverable causes acting upon the nerves, and by taking cognizance of co-existing symptoms which denote diseases of the brain. If two or more cranial nerves, which are proximate within the skull and divergent afterward, be affected, a cerebral affection is probable.

"Cerebral paralysis is infrequently associated with anæsthesia or sensory paralysis. Muscular movements which are independent of the will—namely, those distinguished as reflex and convulsive, or spasmodic—are readily produced in the paralyzed muscles. Movements showing electrical excitability are not lessened, but often increased, if the paralysis be of centric origin. Atrophy of the paralyzed muscles ensues slowly if the paralysis be cerebral. These are points of contrast with spinal and peripheral paralysis. As has been stated, hemiplegia from spinal disease occurs, but the instances are few. A unilateral affection of the spinal cord may give rise to motor paralysis on the affected side, together with sensory paralysis on the opposite side. Affections of the spinal cord giving rise to paralysis are usually bilateral, and, if localized in the upper portion of the cord, or extending from below to this portion, the paralysis is general. A general spinal paralysis is unattended by symptoms which denote central disease, and the paralysis does not involve the facial muscles or the tongue. The orbital muscles are sometimes involved, and myosis is not uncommon. The most frequent form of spinal paralysis is *paraplegia*, especially of the two limbs, with the lower part of the trunk. Paraplegia always implies disease or injury of the dorsal or lumbar portion of the spinal cord. Anæsthesia may or may not be associated; it accompanies much oftener spinal than

cerebral paralysis. The transmission of sensations is often retarded. Incontinence and retention of urine are not infrequent, and these symptoms are rare in cases of cerebral paralysis. Priapism, seminal emissions, and impotency are not uncommon in cases of spinal paralysis. The electrical excitability of the paralyzed muscles is often, but not invariably, either weakened or wanting. Reflex movements may be either increased, diminished, or lost. Atrophy of the muscles which are paralyzed is more constant and rapid than in cases of cerebral paralysis. In cases of paraplegia a sense of constriction, as if a girdle tightly encircled the body, is a common symptom. A peripheral paralysis is usually local, being limited to muscles under the influence of a single nerve, or of only a few nerves. As a rule, anæsthesia is associated with motor paralysis, having limits corresponding to the latter. The electric current, applied to the nerve or nerves posterior to the situation of the lesion, fails to excite the paralyzed muscles; but they may be excited by the current applied anterior to the lesion—that is, between the lesion of the nerve-trunk and the muscles which are paralyzed. The paralyzed muscles quickly become atrophied, and in a notable degree. Symptoms indicative of cerebral or spinal disease are wanting.

"The lesions or morbid conditions of which paralysis—cerebral, spinal, or peripheral—is symptomatic are various; but, aside from those which are traumatic, they are chiefly from hæmorrhage in different situations, thrombosis, embolism, abscess, tumors, sclerosis, etc., the differentiation of which enters into the diagnosis of particular paralytic affections. Of course, in most cases of paralysis the patient's personal and family history, as well as its mode of onset, will help to throw light upon the question whether, in the case before us, we have to do with a paralysis of encephalic, of spinal, or of peripheric origin. But one of the most puzzling forms of paralysis is that which belongs to neither of the divisions mentioned, but is of a functional character, known as hysterical. This paralysis may affect any of the limbs in hysteria, but paraplegia is the more usual form. Hemiplegia is comparatively rare. The muscles retain their nutrition. There is at first a slight loss of irritability to induced currents; but, after a few applications, this becomes normal. At first too considerable electro-cutaneous and electro-muscular insensibility may be present. If the form of paralysis be hemiplegic, the mouth is not affected; if paraplegic, the sphincters are not paralyzed, and there are never any bed-sores. If the arm be the limb affected, and the examiner, after flexing it slightly, lets it go, it will sometimes remain in the flexed position, which it would not do in true hemiplegia. Hysterical speechlessness may be distinguished from aphasia by the patient being able to write down with great facility the wishes she is unable to express in speech; and from localized paralysis of the tongue, by her being perfectly able to swallow.

"In cases of so-called functional or nervous aphonia, a bilateral paralysis of the adductor or constrictor muscles of the vocal cords exists, so that, when the patient undertakes to speak, the vocal cords approximate slightly or not at all; hence the loss of voice which is often restored by measures of treatment directed to the hysterical condition. It is often restored by measures which act solely upon the mind of the patient."

Constipation is not without symptomatic importance in the investigation of disease; but, even in healthy individuals, the number of daily evacuations is subject to much variety. Infants have three, four, or five passages in the twenty-four hours; adults usually but one, and the aged even less. Those who lead a sedentary life, especially if they eat freely of stimulating food, go to stool very rarely—often not more than once in from three to six days. This confined habit of body prevails among females, particularly milliners, dressmakers, and others who sit constantly and eat irregularly. In them constipation leads to other diseases, and is frequently associated with a chlorotic condition, and with neuralgia, leucorrhœa, sick headache, and other evidences of ill health. The use of opium, lead, and astringent medicines generally gives rise to constipation, and it follows the action of many

purgatives. It is nearly a constant symptom of insanity and other nervous disorders, as well as acute inflammation of the brain and its membranes, and of structural diseases of the spinal cord. Whatever presents a mechanical impediment to the passage of fæces through the intestines induces obstinate constipation, as, for example, tumors, strictures, collections of scybala and worms, as well as whatever prevents the intestinal muscles from maintaining the peristaltic action, such as flatulent distention, paralysis, and peritonitis. Fever, from whatever cause arising (inflammation of the intestine excepted), diminishes the secretions of the mucous membrane of this canal—a fact which explains the occurrence of constipation in all such affections, and the origin of the universal employment of purgatives in their treatment. The existence of constipation merely, except in so far as it leads to an excessive accumulation of fæces in the bowels, has but little influence upon prognosis; but this symptom acquires great importance in connection with other symptoms which sometimes accompany it. Thus, when it is accompanied by pain in the abdomen and vomiting, obstruction of the bowels is indicated; and its cessation, under these circumstances, proves the obstruction to have been only temporary. It is of unfavorable import when obstinate in acute affections of the brain.

Pressure of fecal accumulations on the intra-pelvic vessels and nerves induces menorrhagia, uterine catarrh, seminal emissions, hæmorrhoids, cold feet, neuralgia, and numbness of the legs. Constipation also frequently exerts a pernicious influence on primary digestion, indicated by foul tongue, fetid breath, anorexia, acidity, flatulence, biliary disturbance, even jaundice, and urine loaded with lithates. The *remote* or *general effects* of constipation are lassitude of body and mind, headache, flushings and heat of head, vertigo, anæmia, and wasting of flesh from blood contamination due to fecal absorption.

SYMPTOMS RELATING TO MORBID CONDITIONS OF URINE.

The urine is the excretion by which the products of nitrogenous "waste" are eliminated from the body. Alterations in its characters give valuable information regarding tissue-change in the system, and may indicate the presence of disease which would otherwise remain undetected. The pathological indications furnished by the urine relate to its physical character, color, specific gravity, reaction, relative proportion of organic constituents, and presence of materials foreign to this excretion.

Normal Urinary Constituents.

The following table of the amount of urinary constituents excreted by a grown-up man in the twenty-four hours is compiled from Dr. Parke's book on the urine:

Quantity	40 to 50 fluidounces
Total solids	800 to 1,000 grains
Urea	350 to 600 "
Uric acid	5 to 15 "
Chlorine	50 to 150 "
Phosphoric acid	30 to 60 "
Sulphuric acid	20 to 60 "

The urine is always diminished in quantity during the height of a pyrexial disease; a sign of improvement is the increase in the quantity of urine. When a disease is about to prove fatal, the quantity often sinks.

Scheme for the Examination of the Urine.—1. Note the quantity of urine voided within twenty-four hours. 2. Observe the color of the urine, its appearance, if clear, smoky, turbid, etc. 3. Ascertain the specific gravity. 4. Examine the reaction—whether acid, neutral, or alkaline—by means of litmus- or turmeric-paper. 5. Test the urine for albumen; if albuminous, look with the microscope for renal casts, pus corpuscles, red-blood corpuscles. 6. Test the urine for sugar. 7. If there be no albumen or sugar present, and

no deposit, the urine need not be further examined, unless some special indication exist. 8. But if any sediment be observed, it must be examined with the microscope. The following enumeration of the more common deposits may help the student: Pink or reddish deposit, dissolved on heating test-tube—urate of soda; white crystalline deposit, soluble in acetic acid—phosphates; hummocky, white, sharply defined cloud, insoluble in acetic acid—oxalate of lime; white amorphous, flocculent deposit, rendered ropy by alkalies—pus; brownish-red crystalline deposit—uric acid; red amorphous deposit—blood.

Physical Examination.—The physical examination of the urine is the application of the senses to its investigation without the employment of chemical analysis or the microscope. The quantity, color, translucency, odor, and consistence are the only characters which can be ascertained by this simple method of observation.

1. *Quantity.*—The amount of urine passed in twenty-four hours varies very greatly. The average may be roughly stated to be about fifty ounces, and the ordinary variation is about one fifth of the quantity above or below the normal. The quantity is usually increased by anything which raises, and lessened by anything which diminishes, the arterial tension. Thus, cold and nervous excitement will increase it, while warmth and quiet usually diminish it. The quantity passed during the waking hours is much greater than during the hours of sleep; and the fact that a person has to rise during the night one or more times to pass water awakens suspicion of renal disease or of excessive excretion. Although temporary conditions may cause the amount of urine passed in one day to differ much from that of another, yet in healthy people it usually equalizes itself in two or three days, unless there be constant disturbing influences, such as persistent cold. The amount of urinary excretion is known to vary with the quantity of fluids taken into the stomach and the season of the year, being greater in winter than in summer.

Clinical Import.—(*a*) A *persistent increase* in the quantity of urine may indicate diabetes mellitus, polyuria, waxy kidney, or granular kidney. These are diagnosed by the presence of sugar in diabetes, by the entire absence of both sugar and albumen in polyuria, by the presence of considerable albumen in waxy kidney, and by the presence of albumen—though only in small quantity, and of high arterial tension—in granular kidney or renal cirrhosis. The conditions in which *temporary increase* in the quantity of urine occurs are exposure to cold, after fright or great nervous excitement, hysterical fits, copious drinking, the use of diuretic medicines or articles of food containing tartrates or citrates, and the consumption of certain forms of wine and alcohol, as hock and gin.

(*b*) A quantity of urine *below the average* may be due to habit, leading the individual to drink little fluid, or to habitual exposure to heat, leading to excessive perspiration. A decrease in quantity also occurs in acute inflammation of the renal glomeruli or tubules; in subacute exacerbations of chronic inflammatory conditions; in the beginning of febrile attacks; in certain disordered states of the nervous system, as coma; in acute nephritis, and acute or chronic congestion of the kidneys. It also occurs in cases of granular kidney approaching a fatal termination, and is then a sign of grave import.

Irrespective of quantity, the urine is *passed oftener* in acute and chronic cystitis, caruncle of the urethra, vesico-urethral fissure in the female, in gonorrhœa, and in cases of vesical calculus and foreign bodies in the bladder.

2. *Color.*—Urine is ordinarily of a reddish-yellow color; but it may be as colorless as water, or dark-brown black, like porter. A smoky tint is absolutely diagnostic of the presence of blood; a brownish-green suggests the presence of the coloring-matter of bile. Many drugs—as rhubarb, saffron, and santonin—give a peculiar red color to the urine. The carbolic-acid treatment of wounds colors the urine black. Tannin, given by the mouth, renders the urine colorless.

Clinical Import.—*Pale urine* occurs when excretion is rapid and the urine is consequently dilute, as after copious draughts of liquid, or exposure to cold. It is found also in cases of granular kidney, anæmia, chlorosis, diabetes mellitus and insipidus, and after hysterical fits, asthma, or other forms of nervous excitement; also in convalescence from acute disease. A pale urine is a sign that the patient is not suffering any high degree of pyrexia.

High-colored urine occurs in health after food, and after much exercise, and when the excretion is diminished by profuse perspiration. The urine of fever is usually high-colored, from concentration and an excess of the urates. In most acute diseases in which considerable metamorphosis of the tissues takes place it contains much coloring-matter, and urea in proportion to the water. A dirty, bluish urine is sometimes seen in cholera and typhoid fever. Dark urine generally owes its color to bile, hæmoglobin, or blood. Bile gives it various tints of brown or green; hæmoglobin or blood imparts a smoky, blood-red, or coffee color. When blood is mixed with much pus in a strongly alkaline urine, the color may be greenish-brown. In cases of melanotic cancer the urine becomes black after standing.

3. *Translucency.*—In health the urine deposits, after remaining at rest for a short time, a slight cloud of mucus, derived from the bladder and urinary passages; but in all other respects healthy urine is perfectly clear. On cooling, however, it may sometimes become turbid from the presence of urates, which are distinguished from other deposits by their appearing upon the cooling of urine which was perfectly clear when first passed. Should the urine be turbid when first voided, it is a mark of disease, and pus is the most common cause of this appearance.

4. *Odor.*—When the urine loses its natural smell and becomes fetid and ammoniacal, the change is due to the decomposition of urea into carbonate of ammonia and the formation of sulphur compounds; in cases of cystitis and paraplegia, the alteration begins very quickly after being voided. The urine is of a sweetish odor in diabetes, of an organic odor when there is much pus or blood in it, and of an acid, sometimes chloroform-like, smell in rheumatism. Various drugs, as cubebs, and articles of diet, as asparagus, give a characteristic smell to the urine; turpentine gives the odor of violets to this excretion.

5. *Consistence.*—The urine is a limpid fluid, flowing freely from one vessel to another. But in catarrh of the bladder and in retention of urine the ammoniacal products of the decomposition of the urea render the pus present thick and viscid, thus causing the excretion to be ropy and poured with trouble from one vessel to another. This is said to be due to the action of the alkali on the albumen giving rise to the presence of alkali-albuminate. The froth on normal urine readily disappears; but, if the froth be permanent, the presence of albumen or of bile-pigment may be suspected.

Mechanical and Chemical Examination of Urine.—Before passing to this method of interpreting morbid conditions of urine, we may here call attention to the apparatus and reagents which will be found necessary for clinical investigation. These consist of three or four watch-crystals; two or three cylindrical urine-glasses, each containing about six fluidounces; a urinometer, the stem of which is graduated from 0 to 60; blue and red litmus- and turmeric-paper, test-tubes; a spirit-lamp, or Bunsen gas-burner; drop-tubes and stirring-rods; nitric acid; acetic acid; liquor potassæ or liquor ammoniæ (chemically pure); solution of sulphate of copper, ten grains to the fluidounce, or Fehling's test solution for sugar; glass funnel and filtering-paper, and a microscope, which should be provided with a first-class quarter-inch object-glass and eye-piece to magnify not less than 450 diameters. With this apparatus and chemicals all the examinations can be made, and the most important reactions accomplished.

Specific Gravity.—The specific gravity of the urine is estimated by means of the urinometer. In using this instrument, care should be taken that it is clean and dry before it is put in the urine, and that it does not touch the sides of the vessel. The surface of the fluid forms a meniscus, and the

graduation of the stem of the instrument should be read off at the lower edge of the meniscus with the eye on a level with it. The urinometers give the specific gravity at 60° F.; at any temperatures above this they indicate a lower specific gravity, and at temperatures below, a higher specific gravity, than the true one. The specific gravity of the urine depends upon the proportion of solid matters it holds in solution. The amount of water in the urine fluctuates more than the solids, and, therefore, the specific gravity varies also. It is less when the urine is watery, and greater when it is concentrated. The average specific gravity is about 1·020, but it may vary in health between 1·010 and 1·025, or even beyond these limits. It varies in the same person at different times of the day, and in different portions of the urine passed at the same time. If the patient remains quiet in bed, the lower portion of urine in the bladder will be found to have the greatest specific gravity. The specific gravity is diminished during fasting, but is increased after meals on account of the greater excretion of solids when this occurs. It is diminished when the excretion is quickened, or rendered more abundant and watery by drinking copiously of fluids, by exposure to cold, by mental excitement, or by the use of diuretics. It is increased when the urine is concentrated by abstinence from fluids; by profuse perspiration, which carries off much water by the skin; and by long retention in the bladder, which allows some of the water to be reabsorbed. The variation in specific gravity, due to the causes just mentioned, are transitory, and are generally succeeded by variations in an opposite direction, so that the specific gravity of the entire urine passed during twenty-four hours may be little altered.

Clinical Import.—In diabetes insipidus the specific gravity may fall as low as 1·001; in diabetes mellitus it may rise as high as 1·070, and is usually above 1·030. The urine of fevers is usually high, owing to lack of water, the salts being in both real and proportional excess. A persistently high specific gravity generally indicates diabetes mellitus or azoturia. It also occurs in the beginning of acute nephritis with hæmaturia. The specific gravity is increased by the presence of albumen alone as well as by blood. It is an error to suppose that the mere presence of albumen diminishes the specific gravity. If in such cases the specific gravity is diminished, it is due to the absence of other ingredients, and not to the presence of albumen. The experiments of Lauder Brunton have shown that the addition of serum-albumen to the urine increases the specific gravity. Sugar in the urine is the most common cause of a high specific gravity; if this body be not present, excess of urea will be the probable cause. An abnormally low specific gravity is noticed frequently in chronic Bright's disease, immediately after an attack of hysteria, in diabetes insipidus, and in anæmic states. A high specific gravity with a pale color, and a low specific gravity with a deep tint, are equally signs of disease. The knowledge of the specific gravity of a few ounces of urine is a matter of little value. To render the observation in any way serviceable, the whole quantity passed in twenty-four hours must be collected and mixed, and the specific gravity of this taken. A rough estimate of the solid matters passed may be made from the specific gravity in the following way: The two last figures are multiplied by 2 or 2⅓, which gives the amount of solid matters in 1,000 parts of urine; if, for example, the specific gravity of the urine be 1·020, 1,000 grains of urine will contain 2 × 20—i. e., 40 grains of solids, or multiplying by 2⅓ = 46⅔ grains. If but a small quantity of urine be given for examination, it is convenient to dilute it with two or three times its volume of distilled water, and then multiply the specific gravity obtained by the number of volumes of water employed. If three volumes of water were employed to dilute one volume of urine, and the specific gravity of this be 1·005, then four volumes multiplied by 5 would be 20; and 1·020 would be the specific gravity of the urine.

Reaction.—The urine is almost always excreted acid, although it may become alkaline within a very short time after being passed. In the majority of the cases in which the urine is said to be alkaline, as in paraplegia and [cys]titis, the alkalinity is really due to decomposition after being passed. If

the urine is then found to be alkaline, a fresh specimen should be tested immediately after it has been voided. In cases of retention the urine becomes alkaline in the bladder. In health the urine can be made alkaline by the administration of drugs, such as the carbonates, acetates, citrates, or tartrates of the alkalies. When the alkalinity of the urine is due to ammonia, the brown color of the turmeric disappears when the paper is exposed for some time to the air, or gently heated; but the change from yellow to brown is permanent, if the alkalinity be owing either to potash or soda. The urine is rarely neutral to test-paper, so that many observers have denied its occurrence. The most likely cause of the acid reaction of the urine is the presence of the acid biphosphate of soda, and perhaps free lactic and hippuric acids. Very shortly after being voided, the acidity increases, and lasts in health for days, free uric acid being thrown down. Sooner or later, however, the alkaline fermentation sets in, and the urine becomes ammoniacal and fetid from the conversion of urea into carbonate of ammonia and the formation of sulphide of ammonium, while the phosphates and the urate of ammonia are deposited as a white sediment.

Clinical Import.—The acidity of the urine is decreased during digestion and increased by fasting or perspiration. A very acid, high-colored urine is associated with the "uric-acid diathesis." This condition favors the occurrence of calculus and gravel. Alkalinity of the urine is nearly always due, if the administration of alkalies be excluded, to the decomposition of urea into carbonate of ammonia. It is present in some diseases of the spinal cord, and especially in chronic affections of the bladder and urinary organs, as a few drops of urine which have undergone the alkaline fermentation will rapidly beget the same change in perfectly fresh urine. When the alkalinity of the urine is due to a fixed alkali, either potash or soda, it is probably caused by the ingestion of alkaline salts; if not this, to a catarrh of the urinary passages or some alteration in the metamorphosis of the tissues. About this last condition little is known with certainty. Acid urine turns blue litmus-paper red; alkaline urine, red litmus-paper blue. The urine in fever is usually very acid. It is easy to render acid urine alkaline by means of medicine taken by the mouth—almost impossible to render alkaline urine acid by giving acids by the stomach; though this result may sometimes be obtained by means of *meat diet* and the use of iron.

Chemical Examination of the Urine.

Albumen.—To detect, filter the urine, if not perfectly clear.

(*a*) *Heat.*—Place some of the suspected urine in a test-tube, add a few drops of acetic acid, if not already of acid reaction, and boil over a spirit-lamp. Opacity resulting may be due either to albumen or earthy phosphates. Now add a few drops of nitric acid. If albumen, the precipitate remains, or is increased; if due to earthy phosphates, it immediately disappears.

If, after having produced opacity by boiling the urine, we immediately add strong sol. potass. caust., it will disappear if due to albumen, and remain if due to earthy phosphates.

(*b*) *Nitric Acid.*—Allow pure nitric acid to trickle down the tube containing suspected urine, and, if albumen be present, a white zone will be seen at point of contact between urine and acid. An appearance very similar to the above may be owing, however, to the presence of the *urates*; but the application of heat will cause it to disappear if due to the latter, whereas it will remain or be increased if caused by the former. If but a drop or two of acid be used, it may only acidify the urine, and a quantity equal in bulk to urine may redissolve the albumen.

(*c*) *Picric Acid.*—Add, drop by drop, a saturated watery solution of picric acid to the suspected urine, and, as each drop descends through the liquid, it will be followed by an opaque white cloud, if albumen be present. If the quantity of albumen be considerable, this test is a very beautiful one.

To detect Sugar.—A specific gravity of 1·030 or upward affords strong presumptive evidence; and if along with this the quantity of urine voided in twenty-four hours exceeds fifty fluidounces, and is quite pale, the probabilities are increased.

First examine for albumen, and, if present, remove it by boiling or filtration.

(*a*) *Moore's Test.*—Add to urine half its quantity of liquor potassa or soda (which has been kept in a green glass bottle), and boil; if sugar be present, the liquid will assume a yellowish brown color, becoming darker as the boiling is continued. If the quantity of sugar be great, the color will be almost black after prolonged boiling.

Heller's modification of the above consists in now adding a little nitric acid, which will give a clear liquid, having the odor of burnt molasses.

(*b*) Add to the urine one half its volume of sol. pot. caust., and filter to remove the earthy phosphates; then use the following, known as

Trommer's Test.—Add to suspected liquid sufficient of a sol. cupri sulph. to give it a bluish tinge; then add of sol. pot. or soda till the previous volume is increased one half; the precipitate (bluish, if sugar be present; greenish, if not) is the hydrated protoxide of copper (and is redissolved on the addition of more alkali if sugar is present, giving a clear, blue liquid). Now boil, and, if there is sugar, you will have a yellowish precipitate (hydrated cupric suboxide), which, by loss of water, becomes *red* suboxide of copper, and falls to the bottom of the tube. Boiling should not be prolonged. The color must be an actual yellow or red.

Improved Fehling's Test.—Dr. W. S. Hains recommends the following modification of Fehling's test-liquid:

℞	Cupri sulphatis	ʒss.;	
	Glycerini	ʒij;	
	Aqua destil	℥iij.	M. et add:
℞	Potass. hydrat. (in sticks)	ʒjss.;	
	Aqua destil	℥iij.	M.

Stir till any precipitate which may form is redissolved. This solution is perfectly clear, dark blue, and free from sediment.

Heat a drachm or two of the solution in a test-tube until it boils (no change will occur if the solution be well made), add a drop or two of the suspected urine, shake the tube to cause thorough mixture of its contents, and heat as before. If sugar be present in considerable quantity, an abundant precipitate of the yellowish-red suboxide of copper will be found remaining suspended in the liquid for a short time, rendering it almost opaque to transmitted light. If the quantity of sugar be small, no precipitate will appear on the addition of a few drops of the suspected urine.

But now add to the liquid already in the tube an amount of the suspected urine equal to one half of its volume and again apply heat, when, if any sugar be present, the characteristic precipitate of cuprous oxide will appear. If there be no sugar, no change will occur except a lightening of the color of the test-liquid from dilution, and the appearance of the phosphates as a white flocculent precipitate.

Test for Biliary Acids (Pettenkofer's test).—If the presence of biliary acid is suspected, put ʒij of urine in a test-tube, drop in a small piece of lump sugar, and, if *biliary acids* are present, a deep purple hue will show itself on allowing a half-teaspoonful of strong sulphuric acid to trickle down the side of the tube. The color will appear at the junction of acid and urine. Harley believes this characteristic of jaundice from retention, as distinguished from jaundice due to suppression of bile. This test is not applicable to albuminous urine unless the albumen be first coagulated and separated.

Test for Coloring-Matter of Bile.—To test for *biliary coloring-matter*, pour a few drops of the urine on a white plate, and add a few drops of nitric acid, when, if the coloring-matter be present, a play of colors—violet, green, and red—will occur.

Test for Urea.—To test roughly for an excess of *urea*, take two drachms of urine, concentrate by evaporation to one drachm, add equal parts of nitric

acid, and, if there be any excess, the nitrate of urea will crystallize out in abundance.

Tests for Uric Acid.—Acidulate the urine, and let it stand for some hours. The crystals of uric acid formed will be dissolved by heat.

Murexide Test.—Add a few drops of nitric acid, and evaporate to dryness over a lamp. Then a drop of ammonia will produce a rich purple.

Test for Chlorides.—Acidulate with nitric acid, and add nitrate of silver, when at once a dense white precipitate will occur.

Test for Sulphates.—Add a few drops of nitric acid, and subsequently 15 to 20 gtt. of saturated solution of chloride of barium. A heavy or creamy precipitate will be produced if they are in excess.

General Test with Heat and Acid.—If, on boiling a specimen of urine, a white cloud appears, a few drops of mineral acid should be added, and, if due to the presence of phosphates, the cloud will disappear; if the cloudiness is increased or a precipitate thrown down, it is albumen. If the urine is cloudy, and clears up on boiling, the cloud is due to the urates. The formation of a red color on the addition of a mineral acid indicates the presence of urohæmatin.

Microscopical Examination of the Urine.

For microscopical examination of urinary sediment, a lens having a power of 450 diameters is necessary. This is usually reached by a quarter-inch glass. Pus appears as round granular bodies from $\frac{1}{2000}$ to $\frac{1}{3000}$ of an inch in diameter. On the addition of a drop of dilute acetic acid to the edge of glass cover, the corpuscles lose their granular appearance and show from two to four nuclei each. Blood globules appear as bi-concave disks of a pale-yellow color, and vary in size from the $\frac{1}{3000}$ to the $\frac{1}{3500}$ of an inch in diameter. They are often found in *rouleaux.* They may be swelled up, looking like "puff-balls," or be shrunken with crenated edges. Casts are of various kinds, the chief of which are the hyaline, the granular, the blood, the epithelial, the fatty, and the waxy casts. The blood and epithelial casts are found in quantity in acute nephritis; the granular, hyaline, and fatty, in chronic renal disease. Mucus appears under the microscope as thin, filmy lines. Renal epithelium is a trifle larger than a pus corpuscle, and has a distinct nucleus; in acute nephritis it is swelled and has a "cloudy" look; in chronic renal disease it is granular, fatty, and atrophied. Triple phosphates appear as large, prismatic crystals; oxalate of lime, as octagonal and dumb-bell crystals; uric acid, in various shapes, chiefly as rosettes, and distinguished by being of a yellow or reddish-brown color; urate of ammonia appears as spheres or spheres with spiculæ protruding, and of a bluish or brownish color; stellar phosphate of lime, as an aggregation of short rods; spermatozoa, as small spherical bodies having a long cilium or tail attached.

When a urinary sediment is to be examined, about four or five fluid-ounces of the urine should be collected in a tall, narrow, cylindrical glass, and set aside for a few hours. When the sediment has collected at the bottom, the supernatant urine may be poured off, and a drop of the fluid containing the sediment is placed in the center of the glass slide, which must be perfectly clean, and the drop very gradually covered with a piece of thin glass, adjusted with a needle to prevent air-bubbles being present under the glass. In looking for renal casts, it is best to use only the last drops which fall from the vessel.

The clinical import of the more noteworthy morbid conditions of the urine will now be considered in the order suggested in their chemical and microscopical examination.

Clinical Import of Albuminuria.—Albumen in the urine is much more common than is usually supposed, and has been found to occur in eleven per cent of apparently healthy persons presenting themselves for life-insurance. Its significance in such persons has not been completely ascertained, but it

has been found that in many such cases, when they are kept under observation, the health goes on deteriorating. Intermittent albuminuria is not infrequent in persons who have been exposed to malaria. In contracting kidney the albumen is usually small in quantity, and may also be completely intermittent, traces of it appearing only in the urine passed after meals, and being entirely absent from urine passed in the morning. In the experience of Lauder Brunton, this has occurred even when the patient was in a very precarious condition, and already suffering from nephritic asthma. Some authorities hold that albuminuria may be quite absent in granular disease. Clinical experience, however, teaches that the presence of albumen in urine is an important objective sign of disease. Any state which brings about a mechanical impediment to the return of blood from the kidneys will be accompanied by albumen in the urine, and the albumen will be persistent so long as the congestion of the kidney continues; the longer the albumen remains in the urine, the greater danger is there of permanent textural injury to the kidney. In many acute febrile diseases, albumen is often present, which, as a rule, disappears with the termination of the illness; *but, if persistent, it affords evidence of organic disease of the kidneys.* In a chronic non-febrile disorder, there being no hindrance to the return of the blood from the kidneys to the heart, *the discovery of albumen in a clear urine would point to structural change in the kidney.* The *search for renal casts* must always follow the detection of albumen in the urine. The discovery of these structures renders it certain that the albumen, or at least a part of it, is derived from the kidney. A common cause of the presence of albumen is pus, according to its quantity; in the urine of women, a small quantity of albumen is often due to leucorrhœal discharge, which is composed chiefly of pus. Gleet and also, it is said, a great quantity of semen cause albumen to be present in the urine. If blood be present in the urine, albumen must likewise be present, derived from the corpuscles and plasma. "Egg-albumen" and "pro-peptones" readily pass through the kidney. It has, however, been recently ascertained that, if egg-albumen is made to pass through the kidneys for a length of time, the kidneys themselves undergo structural change, glomerular nephritis being induced. Clinical observation tends to prove that albuminuria with structural kidney change may *often be secondary to continued indigestion.*

Clinical Import of Glycosuria.—If the foregoing tests announce the presence of sugar in *considerable quantity* as often as the urine is examined, *diabetes mellitus* may be inferred to exist. But, should the presence of sugar in the urine be variable and the amount small, the fact is not of any known great diagnostic or therapeutic importance. Healthy urine is supposed to contain about ·01 per cent of sugar. It has been ascertained that a healthy man excretes daily through the urine about 15 grains of sugar. Its quantity is increased during convalescence from some acute disorders, especially cholera, malarious diseases, and carbuncle. Certain injuries of the nervous system also bring on glycosuria. The excretion of sugar in diabetes is far greater during the night than during the day; urea follows just the opposite rule.

Clinical Import of Biliary Acids and Pigments.—The bile acids and pigments are present in the urine in most cases of jaundice. In hot weather, the bile pigments may sometimes be detected, by means of "Gmelen's test" (nitric acid), in the urine of persons who are not jaundiced. In fact, some believe that the bile pigments are always present in small amount in health, and the same may be said of the bile acids. The quantity of bile acids present in jaundice is scarcely ever ·02 per cent, if the estimates on record may be trusted.

Clinical Import of Urea.—Urea is the body characteristic of the urine; unless a fluid contain urea, it can not be called urine. Healthy urine may be looked upon as being chiefly a solution of urea and chloride of sodium, one half of the solids being made up of urea and one quarter of chloride of sodium. Urea is therefore the most important constituent of the urine. A healthy man excretes from 300 to 500 grains in the twenty-four hours. Its ·ount is increased in health by a high meat-diet, and decreased by purely

vegetable food. In some acute diseases, as pneumonia, typhoid fever, and acute rheumatism, it is said to be greatly increased, owing to the excessive tissue metamorphosis; it may be present in such quantity as to give a precipitate without previous concentration when the urine is acidulated with nitric acid. It has, however, been found in these cases that, though the percentage of urea be high, owing to the small amount of urine passed, yet the total amount of urea is in many cases below the standard of health. In chronic diseases, especially those attended by cachexia, or in uræmia, and in chronic Bright's disease, the amount of urea is below the average. In diabetes, the amount of urea excreted in twenty-four hours is increased, although the amount per cent of urea is much decreased by the excessive flow of water which passed out through the kidneys.

Clinical Import of Uric Acid.—Uric acid is a less oxidized stage of urea. It is found in the urine of all carnivorous animals. In that of reptiles it entirely replaces (from insufficient oxidation) the urea in the urine. Deposits of urates occur readily after any violent exertion or perspiration, or after errors in eating or drinking. People are often frightened by such deposits; but they are of no importance, unless they should persist for a length of time. Persistent deposits occur in febrile conditions or deep-seated organic disease. The excretion of uric acid is usually increased *pari passu* with the urea in pyrexia or acute rheumatism and in chronic liver diseases. It is increased out of proportion to the urea in leucæmia. An excess of uric acid is observed after an attack of gout; it is often entirely absent from the urine immediately before the paroxysm, and may disappear for days when this disease has become chronic. In cirrhosis the urine is sometimes heavily laden with the urates. A healthy man excretes on an average about seven or eight grains of uric acid in the twenty-four hours.

Clinical Import of Chlorides.—Chlorine is present in the urine, in combination with ammonia, fixed alkalies, or alkaline earths. The quantity depends chiefly on the amount of salt taken in the food. When this is constant, the excretion is also tolerably constant. On an average, a healthy man excretes about two hundred and fifty grains of the chlorides (mainly of sodium) in the twenty-four hours. During acute pneumonia, acute rheumatism, and most other pyrexial diseases, *the chlorides diminish in quantity, or even disappear from the urine.* Their appearance in *daily increasing quantity is a sign of the diminution of the intensity of the disease.* The amount of chlorides apparently depends upon the digestive powers of the patient even in chronic diseases.

Clinical Import of Phosphates.—The amount of phosphoric acid excreted by a healthy man in the twenty-four hours is about fifty grains. Two kinds of phosphates are found in the urine—phosphate of lime, and the ammonio-magnesian, or triple phosphate. They are always deposited when the urine becomes alkaline through fermentation, and, when feebly acid urine is heated so that the carbonic acid is driven off, phosphates are precipitated in the form of a cloud, which might be mistaken for albumen, but clears up on the addition of a drop of acid. In persons having little exercise and a good deal of brain work, the urine may be turbid when passed, from phosphates present in it. This usually passes away when they get more exercise. It may continue for months, and is of importance only in so far as it renders the patient liable to the phosphatic calculus. Such deposits do not indicate increased quantity of phosphates in the urine, but are simply due to diminished acidity. Lauder Brunton has found the actual quantity of phosphates present in such turbid urines less than in specimens of clear urine from the same individual. The occurrence of stellar crystals of phosphate of lime in quantity in the urine is, according to Roberts, of grave import, indicating serious disease of some kind or other, although a few such crystals are sometimes seen in normal urine. The triple phosphate almost invariably occurs in ammoniacal urine, and generally appears after urine, alkaline from any cause, has stood for some time. The quantity of phosphates is increased in febrile disorders from increased tissue metamorphosis, and in dis-

eases of the nervous centers and bones. It is diminished in Bright's disease and sometimes in dyspepsia, as well as after the disappearance of febrile conditions.

Clinical Import of Sulphates.—The quantity of sulphuric acid excreted by a healthy man in the twenty-four hours is about thirty grains. The quantity of the sulphates is increased by a full animal diet. Their increase denotes diminished excretion of bile.

Clinical Import of Pus.—Pus occurs in the urine in the following diseases: Leucorrhœa in women; gonorrhœa, or gleet, in men; pyelitis, from any cause; cystitis, any abscess bursting into any part of the urinary tract.

Clinical Import of Blood.—The presence of blood or of blood corpuscles in the urine is a sign of hæmorrhage from the kidney or from the urinary passages. It may result from: 1. *Disease of the kidney*—such as acute Bright's disease, acute congestion of the kidney, cancer of the kidney, or from external injury of these organs. 2. *Diseases of the pelvis and ureter:* Calculus in pelvis or ureter; parasite, as belharzia hæmatobia; cancer. 3. *Disease of the bladder:* Calculus, cancerous, or villous growth; congestion or ulceration of mucous membrane. 4. *Disease of urethra:* Congestion, as in gonorrhœa; tearing of the mucous membrane from mechanical injury. 5. *In women*, from uterine discharges, as menstruation, etc.

If the amount of blood in the urine be small, the chances favor the belief that the blood is derived from the kidney; search must, therefore, be made for renal casts. If the amount of blood be large, it probably comes from the pelvis of the kidney, ureter, or bladder; if from the pelvis of the kidney, there will be pus and probably also gravel in the urine, with pain in the loins, passing down into the thighs and testicles. If there be none of these indications, the blood probably comes from the bladder. It is commonly said that, if the blood be completely mixed with the urine, the hæmorrhage is from the kidneys; if the urine first passed be clear, and that at the end of micturition it becomes bloody, or even pure blood be passed, the hæmorrhage is from the bladder or prostate gland; while, if the first portion of the urine be bloody and the last drops clear, the hæmorrhage is from the urethra. These rules will, however, often be found to fail. The chief danger from hæmaturia is the formation of clots in the passages, and consequent ischuria. Small clots may sometimes form the nucleus of a calculus.

Clinical Import of Mucus and Epithelium.—Mucus is a constant constituent of every urine, and, if healthy urine be allowed to remain at rest for an hour, a light cloud will be found to have settled at the bottom of the urine-glass; on examination with the microscope, it will be found to consist of mucus-corpuscles and epithelial scales detached from the surface over which the urine has passed. An excessive quantity of mucus denotes vesical catarrh. The urethra and bladder give up a roundish or oval epithelium cell to the urine. In women these may be mixed with squamous epithelium from vaginal excretion, especially if subject to leucorrhœa. *Under irritation, the mucous membrane of the pelvis and ureter will produce cells, caudate, spindle-shaped, and irregular, very like those formerly looked upon as diagnostic of cancer.* From this circumstance it is impossible to speak positively of the existence of cancer-cells in the urine. Desquamation of the tubular epithelium of the kidney occurs only in disease. These cells, as seen in the urine, are slightly swollen, and acquire a more spheroidal and less distinctly polygonal shape, apparently from the imbibition of fluid and the removal of pressure. The cells are frequently granular, and contain fat drops, or are contracted, withered up, and shriveled.

Clinical Import of Renal Casts.—In Bright's disease and in congestion of the kidney there are formed in the uriniferous tubules lengthened cylinders, which are discharged with the urine, and form the deposit known as "casts." Those found in the urine are, probably, chiefly formed in the straight uriniferous tubes; and the view of their origin which heretofore found most favor ·s that the casts were formed by the escape of blood or plasma into the ›s of the kidney, and coagulation of the fibrin, which then became

molded to the shape of the tube into which it had been extravasated. It is possible that many of the hyaline casts are formed in this way; but the balance of evidence at the present time is in favor of the epithelial and granular casts being produced by a desquamation and degeneration of the renal epithelium. With a little experience the student will become familiar with the appearance of casts, and will at once be able to distinguish them from foreign bodies in the urine. They are never broader than six or less than two red-blood corpuscles in diameter; but they vary considerably in length, never, however, exceeding the one-fiftieth of an inch. Casts may be conveniently divided, according to their appearance under the microscope, into three kinds—the *epithelial*, the *granular*, and the *hyaline*. The presence of casts in the urine is a sure sign of disease of the kidneys, but not, however, of permanent disease of these organs. They are present in many acute diseases, accompanied by albumen in the urine; *but, if they are found for several weeks together, after all fever has subsided, then permanent disease of the kidney may be inferred.* Casts are constantly present in the urine in all cases of congestion of the kidneys and of acute or chronic Bright's disease. But no certain information as to the nature of the disease existing in the kidney—for example, whether lardaceous or otherwise—can be had from the characters of the casts, since all forms of Bright's disease end in fatty changes.

Some of the leading characters of the renal derivatives in the chief forms of kidney affection may, however, now be mentioned:

In *congestion of the kidney* the casts are chiefly hyaline, seldom showing any marks of fatty change. Very rarely may blood or epithelial casts be discovered. At the beginning of *acute Bright's disease* the urine deposits a sediment which consists of blood corpuscles, the "blood casts" of some authors. After this period the amount of blood present is not so great, but a great desquamation of the renal tubules takes place; renal epithelium and epithelial casts are found in great numbers; the epithelium has undergone little if any granular change; hyaline casts are observed together with epithelial. In the subacute stage the changes in the epithelium may be almost daily observed; at first they become granular, cloudy in appearance, which change often goes on to fatty degeneration, and the epithelial cells then contain large fat drops, while epithelial casts undergo a like change. If the patient recover, these casts and epithelium slowly disappear from the urine. But in *chronic Bright's disease* numerous forms of casts are still met with: the hyaline, both narrow and wide forms; the larger are often beset with granules dissolved on the addition of acetic acid. Epithelial casts are rare except in febrile exacerbations, when the renal derivatives found in acute Bright's disease are present, together with granular and fatty casts, which is evidence of the previous alteration of the kidney. In *lardaceous* or *amyloid kidney* the urinary deposit contains hyaline casts, which sometimes give the amyloid reaction, and are often accompanied by pus corpuscles. Atrophied epithelial cells, becoming fatty in the latter stage of the disease, are almost invariably present.

Clinical Import of Fungi.—Many kinds of fungi grow in the urine after it has been voided for some time, and when ammoniacal decomposition sets up. The most important are bacteria. The penicilium glaucum, the fungus which forms "mildew," often appears when the acid fermentation has begun. The yeast fungus, torula cerevisiæ, or saccharomyces urinæ, are oval cells about the size of a blood corpuscle, and are joined together in a row. These have been regarded as diagnostic of diabetes. Kiestein is a whitish pellicle formed on the surface of the urine of pregnant women, when allowed to remain at rest for a few days. It appears to consist chiefly of the mold fungus, globules of fat, and crystals of phosphates. *Formerly it was thought to be a sign of pregnancy;* but it is seen in the urine of men, and is not always present in pregnancy.

Clinical Import of Spermatozoa.—These little bodies are present in the urine of men first passed after an emission of semen. A few pass away

the urine probably without venereal excitement, especially when the person is continent. In the urine of women they are almost positive proof of sexual intercourse. The seminal excretion forms a glairy white deposit at the bottom of the urino-glass. When examined with a microscope (for which a high power magnifying 400 or 500 diameters is best, although a power of 250 will identify them), spermatozoa show the characteristic oval head or body, often somewhat pear-shaped, and long, delicate tail, two or three times the length of the head. In the urine no movement is ever shown by these bodies.

According to Beale, there is a form of vegetable growth occasionally found in urine which bears a striking resemblance to spermatozoa.

Physical Signs of Disease.

The object of a physical examination is to ascertain the precise seat, limits, and characters of those evidences of disease which are recognizable by our senses, and which are called physical signs. In making such an examination, we bring to bear all our senses with whatever instrumental aids may be available to detect the signs of disease; and, as has been stated, in order to detect them, the following methods are employed: *Inspection*, *palpation*, *mensuration*, *percussion*, and *auscultation*.

Inspection reveals the following points of diagnostic value: Condition of the surface; abnormalities of outline and contour; deformities; abnormal growths, their character and situation; abnormal or deficient movement of parts, especially in the chest and abdomen; abnormal points of pulsation; abnormal conditions of vessels; and other abnormal appearances of some special region of the body.

Palpation (sense of touch) also reveals important diagnostic information with reference to the condition of the surface; condition of the deeper tissues; outline and character of new growths; abnormality of movement of parts, as of chest and abdomen, of tumors; the heart impulse; abnormality of transmitted impulses, as in vocal fremitus, cough, impulse of hernia, etc.

Mensuration is a method of estimating size, which is employed in disease to secure greater accuracy. By it may be learned how far the dimensions of one side of the chest exceed those of the opposite side, or what increase or diminution of bulk has taken place in a part within a given time. The progress of emaciation, the increase or subsidence of effusions, the growth of tumors, the return of parts to their normal dimensions, may thus be determined with great precision. The measurements in question are usually made with a tape-line divided into inches and fractions of the same. In order to be comparable with one another, they must always be made as nearly as possible under the same circumstances. The same points must be selected on each occasion. In the chest, the most convenient is the nipple in the male and the lower edge of the mamma in the female. The circumference at full inspiration and that on full expiration should be measured: it is evident that the mean between the two will represent the average capacity of the chest examined. This is the measurement of the thorax most commonly employed in practice, because the changes effected by disease in the whole of either side always affect the capacity, and therefore the circumference. Local enlargements of the chest, such as depend upon effusion into the pericardium, aneurism, etc., are not readily susceptible of measurement, but the practiced eye detects them without much difficulty. In measuring the chest, it should be remembered that there are certain departures from perfect symmetry which yet do not indicate the existence of disease. Thus the right side of the chest is usually more capacious than the left, and its circumference may measure half an inch more; lateral curvatures of the spine, projections of the ribs, contractions resulting from a former attack of pleurisy, and other partial deformities, are to be taken into consideration in estimating the value of thoracic measurements. In measuring a dropsical abdomen, the level of umbilicus is the most convenient situation; but in this and all other

applications of mensuration the patient should assume the same position at each repetition of the operation.

Percussion, by the note produced, determines the *relative solidity* of parts. Its note varies between that obtained over cavities filled with air and having thin, tense walls, called the *tympanitic* percussion note, and that obtained over fluid and solid tumors where all air is excluded, called *flat* percussion. The percussion note is sometimes, also, modified by the *force of the percussion stroke*. Percussion is of much importance in the investigation of disease of the respiratory organs. The signs obtained by percussion are six in number—namely, flatness, dullness, tympanitic, vesiculo-tympanitic, cracked-metal and amphoric resonance. The two last-named signs may with propriety be reckoned as varieties of tympanitic resonance.

Flatness is the absence of resonance. It is illustrated by percussing over a mass of bone and muscle. With this definition, flatness represents the following morbid physical conditions: The presence of liquid in the pleural cavity or in the air vesicles; complete solidification of lung and an intra-thoracic tumor. One of these conditions must be present whenever there is flatness on percussion. This sign thus enters into the physical diagnosis of pleurisy with large or considerable effusion, empyema, pneumonia in the second stage, pulmonary œdema, and in some cases of cancer of the lung.

Dullness is heard over partial consolidation, and means more or less diminution of the normal resonance. It has every degree of gradation between the slightest appreciable diminution and the closest approximation to flatness. Increase of solids, as in pneumonia, phthisis, and carcinoma, or of liquids, as in œdema, pleurisy, hydro-thorax, and pulmonary congestion, or diminution of air, as in collapse of pulmonary lobules—occasion dullness on percussion, provided these physical conditions are not sufficient to produce flatness. The different degrees of dullness are distinguished as slight, moderate, considerable, and great or very great. The pitch of sound in dullness is always higher than that of the normal resonance of the patient.

Tympanitic resonance is heard over air in a large cavity with tense walls or it exists when devoid of the vesicular quality which characterizes the normal resonance. The pitch is always higher than that of normal resonance. This sign is obtained in the following affections: pneumo-thorax, or air in the pleural sac; pulmonary cavities which, when not filled with morbid products, contain air; and affections in which there is solidification of lung over the primary and secondary bronchii. The affections last referred to are pneumonia affecting the upper lobe, and phthisis. The tympanitic resonance in such cases is derived from the air in the bronchial tubes, the intervening pulmonary solidification excluding vesicular resonance. A tympanitic resonance is often propagated upward from the stomach and sometimes from the colon, especially when the lower lobe of the lung is solidified.

Vesiculo-tympanitic resonance, as the name signifies, is a tympanitic resonance with an admixture of more or less of the vesicular quality of the normal resonance. Its intensity is greater than the resonance of health—it is sometimes notably so. The pitch of sound is also higher than that of the normal resonance of the patient. A vesiculo-tympanitic resonance is the percussion sign of pulmonary or vesicular emphysema. It is also produced by percussing over lung above the level of liquid in cases of pleurisy with moderate effusion, and over the unaffected lobe in cases of lobar pneumonia on the side of the affection.

Cracked-metal and Amphoric Resonance.—In these signs the resonance is tympanitic, with the addition in the first of a chinking sound and in the second of a musical tone resembling that produced by blowing over the open mouth of a phial. The resonance is not infrequently both cracked-metal and amphoric. They each have the same significance. They denote pulmonary cavities with thin, tense walls communicating with a bronchus. Firm percussion should be employed to produce these varieties of percussion note, and the patient's mouth should be kept open. In some instances these sounds may be obtained when no pulmonary cavity exists, as, for instance,

solidified lung intervenes between the chest-wall and the bronchi exterior to the lung, the signs then being derived from the primary bronchi. In rare instances they may be produced in healthy children by percussing over the site of these bronchi. An acquaintance with the characters of the normal vesicular resonance and of the disparity between the two sides of the chest in different regions is essential as preliminary to the study of signs of disease obtained by percussion.

Auscultation (sense of hearing) admits of the detection of abnormal sounds which are often of great diagnostic value. These sounds vary with different diseases, and are of especial value in diseases of the lungs, heart, and blood-vessels. The prominent *auscultatory signs* of disease referable to the respiratory system may be thus enumerated:

Varieties of Respiration.

"*Normal*, or 'vesicular,' is a breezy sound, like the rustling of wind through the trees.

"*Rude*, or 'broncho-vesicular,' is due to partial consolidation of lung; it is an admixture of tubular and vesicular breathing combined in variable proportions; the bronchial character of the breathing being in proportion to the solidification—the expiratory sound being more prolonged and high in pitch. This sign is presented in varying gradation in the resolving stage of pneumonia, in cases of phthisis, and whenever the solidification is not sufficient to produce a purely bronchial respiration.

"*Tubular*, or 'bronchial,' respiration is due to complete consolidation of lung. The conditions which it represents generally occasions notable dullness or flatness on percussion. The correlative vocal sign is *bronchophony*, the voice of the patient being concentrated apparently near the ear and raised in pitch.

"*Exaggerated*, or 'puerile,' respiration is so called since it is normal in childhood, and is produced when the lung is doing double duty, as when there is unilateral diminution of function from pneumonia, or suppression from any cause.

"*Amphoric* respiration occurs in cavities with *tense walls* opening into a bronchus and near the surface. This sign is often present in cases of pneumo-thorax from perforation of the lung, and it is frequently associated with metallic tinkling—a sign heard with respiration, voice, whisper, and cough.

"*Cavernous* respiration occurs in cavities with *flaccid walls* opening into a bronchus and near the surface. Its characters are lowness of the pitch of the inspiratory sound, which has a simple blowing quality, that is neither vesicular nor tubular, and an expiratory sound still lower and of the same character with respect of quality and pitch. The correlative vocal sign is increased vocal *resonance* and *pectoriloquy*, the speech being transmitted through the chest-walls. This is, however, not exclusively a cavernous sign. It may be a sign of solidification of lung. With cavernous respiration are often associated cracked-metal and amphoric resonance on percussion.

"*Emphysematous* respiration is characterized by a shortened inspiration and a prolonged expiratory sound of *low pitch*.

"*Phthisical* respiration is where the expiratory is prolonged and of *high pitch*.

"*Cog-wheel* respiration occurs when the inspiratory sound is *jerking* and interrupted. It is due to unequally distributed impairment of the lung elasticity, as in early tubercular deposits. Pleuritic adhesions may have the same effect.

"*A bilateral, diminished*, or *suppressed respiratory murmur* may be due to obstructive conditions within the larynx or trachea, to paralysis of the diaphragm or costal muscles of both sides.

"*A unilateral diminution* or *suppression of respiratory murmur* denotes ther obstruction of the primary bronchus, or diminished movements on the ected side, either from pain or paralysis, provided these are the only signs.

Pleuritic effusion, pneumo-thorax, and solidification of lung may suppress the murmur on one side, but other signs are then present representing these conditions.

"*Adventitious Auscultatory Signs.*—The auscultatory signs produced by the acts of respiration just described are abnormal modifications of the signs obtained in health. We now call attention to certain new or adventitious sounds; these are called râles.

"*A râle* or *rhonchus* is a sound produced by impediment to the entry or escape of air within the lungs or bronchial tubes. The impediment may be due to narrowing or secretion within the tubes, to secretion within the alveoli, or from destructive softening or œdema of the lung-tissue. The *râles* that may be audible over the chest are: *sonorous*, *sibilant*, *crepitant*, *sub-crepitant*, *mucous*, *dry crackling*, *moist crackling*, *and cavernous.*

"*Sonorous and sibilant râles* are noises of a snoring or whistling kind, which are produced in the air-passages—audible with both inspiration and expiration, or with either, and for the most part transitory, being temporarily or permanently removed by cough, or, in other cases, by the relief of the spasm which has occasioned them. The sonorous are due to *partial occlusion* of a large *bronchial tube* by tumefaction of the mucous membrane, spasm of the muscular fiber, or the presence of mucus. The *sibilant* are due to a similar condition of a *small bronchial tube.*

"*Crepitant râle*, or *fine, dry crepitation*, is a minute dry crackling sound, occurring chiefly in the latter part of inspiration. The sound has been compared to the crackling of salt upon the fire, or that produced by rubbing a pinch of hair between the fingers close to the ear. This sound is due to the agglutination of the walls of an air-cell, which are subsequently separated by the entrance of air. There are at least four conditions which will give rise to identically the same sound, as far as the ear can appreciate it: (1) incipient pneumonic consolidation (inflamed œdema stage); (2) œdema of the lungs, when not excessive, as in certain stages of kidney disease, in obstructive heart disease, etc.; (3) mere collapse of lung from disease, in which it is often temporarily heard at the extreme posterior bases, disappearing after a few deep inspirations; and (4) certain cases of œdema of the pleura, dependent upon old lung disease. The fine crepitation of pneumonia is peculiar only in being associated with commencing tubular breath sound, the associated consolidation giving an increased intensity and definition to the crepitant *râle.* When associated with acute febrile symptoms, fine crepitation indicates the congestive stage of acute pneumonia. If seated about the base, the pneumonia is most commonly of the typical croupous or exudative variety. If at the apex, or in patches, the disease may be incipient, catarrhal, or embolic (pyæmic) pneumonia.

"*Sub-crepitant* or *muco-crepitant râle* is a fine, bubbling *râle* of sharp definition and well conducted to the ear, audible principally during inspiration, but, in less degree, also with expiration. This *râle* is produced in the minute bronchioles and alveoli by the penetration of air through a thin liquid. A certain amount of lung condensation is necessary to give sharpness of definition to the sound. Sub-crepitant *râle* is most typically heard in the resolution stage of pneumonia. In the second (secretion) stage of broncho-pneumonia it is also heard. In some pneumonic forms of phthisis many degrees of fineness or coarseness may be distinguished in different parts of the same lung; but it will generally be found in such cases that the *râle* increases in coarseness as we ascend from below upward.

"The *mucus râle* is due to the flapping of mucus in the tubes, or the passage of air through mucus, pus, serum, or blood.

"*Dry crackling* is a term used to describe a râle consisting of three or four distinct small crackles heard during inspiration. It most commonly signifies commencing softening of tubercular deposit, and the sound may be most frequently recognized in the sub-clavicular region—the inspiratory breath-sound being feeble and hoarse, and the expiratory sound harsh and prolonged.

"*The moist crackle*, or *humid clicking râle*, consists of a few crackles heard during the latter part of inspiration and the commencement of expiration. It is sharply defined, sometimes metallic in quality. It is significant of liquefaction of tubercular or caseous pneumonic nodules in communication with bronchial tubes, and as such adjacent softening coalesce and increase in size the crackles become larger, until they develop into the *gurgling* or *cavernous râle.* The moist crackle may be associated with other *râles*, since a softening caseous nodule is often surrounded by congested pulmonary tissue or pneumonia, giving rise to fine crepitant or sub-crepitant sounds.

"*Cavernous and gurgling râles* are but larger and more liquid *râles*, due to bubbling of air through fluid in a *cavity* in the lung, and, when the bronchus is below the level of the fluid, it has a peculiar metallic, hollow sound."

Of these râles, all but one are heard with both inspiration and expiration, this one exception being the *crepitant* râle, which is heard only at the end of expiration.

An acquaintance with the characters of the auscultatory signs in health, and with the variations presented between the two sides of the chest and in different regions, is an essential requirement for the study of the signs representing morbid conditions.

The significance of the correlative pulmonic signs are (after the plan of Professor Da Costa) well shown in the table on page 149.

Cardiac Murmurs.

Normal Heart Sounds.—The *first* or *systolic sound* is distinguished by striking of the apex of the heart against the chest-wall, and is synchronous with the radial pulse. It is longer in point of duration than the second sound, since it is due to the continued effect of four causes, as follows: (1) the blow of the apex upon the chest-wall; (2) the friction of the muscular fibers of the ventricles; (3) the rush of blood in the ventricles; (4) the closure of the auriculo-ventricular walls.

The *second* or *diastolic sound* is distinguished by a short, sharp sound, which is produced by closure of the aortic and pulmonic valves.

Abnormal Heart Sounds.—All murmurs either precede, accompany, or follow immediately one of the sounds of the heart. The "*rhythm of murmur*" is the relation of the murmur to the *sounds of the heart.*

Presystolic Murmurs.

Mitral obstructive is heard with greatest intensity over a circumscribed space at the apex. It is characterized by a *purring* sound, and is the loudest and longest of all the murmurs.

Tricuspid obstructive is heard with greatest intensity along the margin of the fifth and sixth costal cartilages, on the left border of the sternum. Its area of diffusion is over the right ventricle and rarely above the third rib.

Systolic Murmurs.

Mitral regurgitant is heard with greatest intensity at the apex. Its area of diffusion is *carried to the left*, and is often heard between the fifth and eighth dorsal vertebræ, or at the angle of the scapula.

Tricuspid regurgitant is heard with greatest intensity between the fifth and sixth ribs along the sternum. Its area of diffusion is over the right ventricle and *rarely* above the third rib. It is a *loud blowing murmur.*

Aortic obstructive is heard with greatest intensity at the second costo-sternal articulation of the right side. Its area of diffusion is *upward along the carotids.* Inaudible at the apex.

Pulmonic obstructive is heard with greatest intensity over the seat of the valves at the junction of the third rib and sternum of the left side. Its area of diffusion is carried *toward the left shoulder.*

… CLINICAL IMPORT.

PERCUSSION-NOTE OR SOUND.	AUSCULTATION OF RESPIRATION.	AUSCULTATION OF VOICE.	VOCAL FREMITUS.	RÂLES, OR RHONCHI.	PHYSICAL CONDITION.
Clear. (Resonance proportionate to amount of lung-tissue.)	*Vesicular murmur*, or its modifications. (Most distinct where lung is thinly covered.)	Normal "vocal resonance." (Louder on right than left side of chest.)	*Unimpaired.* More perceptible on *right* than *left*, and in *upper* than *lower* part of thorax.	*None*, or only slight *mucous* râles after a few deep inspirations.	Nearly, if not completely, *normal lung-tissue.*
Clear or only *slightly* dull. Chest equally "resonant" on both sides.	*Broncho-vesicular.* Expiratory sound exaggerated and prolonged.	*Nearly* normal resonance, or slightly intensified.	About normal. In children, *bronchial fremitus*, from collection of mucus.	Coarse or "sonorous" in larger, "sibilant" in smaller, fine or "mucous" in the capillary or smallest bronchial tubes.	*Bronchitis.* Especially in its *acute*, but also in its more chronic form.
Dull or toneless, or with an increase of "pitch," and a greater sense of resistance.	*Bronchial* or *rude*, with more or less increase of "pitch."	*Bronchophony.* Words conveyed with "brazen" clearness into ear of the listener.	*Increased.*	*Dry* ("sonorous" or "sibilant") or *crackling.*	*Solidification* of lung, due either to pneumonitis, phthisis, or tumor, and possibly to condensation of lung-tissue from dilatation and thickening of bronchial tubes.
Dull, and varying with position of patient.	*Absent*, with deficient "respiratory movement."	*Usually absent.* Occasionally "ægophony."	*Diminished.*	*Dry*, "sonorous."	*Effusion* within the pleural cavity.
Tympanitic, or "extra resonant."	*Cavernous* (or feeble according to cause).	*Uncertain.* ("Cavernous" or diminished.)	*Uncertain* (usually diminished).	*Dry* or *moist.*	*Increase of air in the chest*, as in either pneumo-thorax, emphysema, or a cavity.
Amphoric or *metallic.*	*Amphoric* or *metallic.*	*Amphoric* or *metallic.*	Uncertain, usually *diminished.*	*Large bubbling* or "gurgling."	*Large cavity with elastic walls.*
"*Cracked metal.*" (Sound heard when patient's mouth is open.)	*Cavernous.* (Inspiratory sound of a "blowing" character. Expiratory of a "whiffing" metallic note.)	*Cavernous whisper* (with blowing sound low in "pitch").	*Uncertain.*	Hollow, *bubbling*, or "gurgling."	Generally a *cavity in communication with bronchus.*

Diastolic Murmurs.

Aortic regurgitant is heard with greatest intensity at the third costo-sternal articulation on the right side. Its area of diffusion is carried *down the sternum* to the xiphoid appendix, and it *may be* heard at the apex.

Pulmonic regurgitant is heard with greatest intensity over the seat of the valve at the junction of the third rib and the sternum of the left side, and is carried down to the apex.

In addition to the above-mentioned murmurs there may also be—

Anæmic murmurs, heard with greatest intensity *in the carotids.*

Ventral murmurs are produced within the left ventricle, from roughening of the chordæ tendinæ, or the ventricular surface of the mitral valves, or by an abnormal direction to the current of blood as it passes through the ventricle. These are very rare.

TABLE OF CARDIAC MURMURS (Loomis).

PERIODS OF HEART'S ACTION.	SEAT OF MURMUR.		CAUSE OF MURMUR.
SYSTOLIC.	Left side of heart.	Aortic.	Obstruction to the onward flow of blood through the aortic orifice, or aorta.
		Mitral......	Regurgitation of blood through the mitral-valve into the left auricle.
	Right side of heart.	Pulmonary.	Obstruction to the onward flow of blood through pulmonary orifice, or through pulmonary artery.
		Tricuspid..	Regurgitation of blood through the tricuspid orifice into right auricle.
DIASTOLIC.	Left side of heart.	Aortic.	Regurgitation of blood through the aortic orifice into left ventricle.
		Mitral......	Obstruction to the flow of blood from left auricle to left ventricle.
	Right side of heart.	Pulmonary.	Regurgitation of blood through the pulmonary orifice into right ventricle.
		Tricuspid..	Obstruction to flow of blood from right auricle into right ventricle.

If a murmur is heard with the first sound of the heart, it is almost certainly aortic obstructive, or mitral regurgitant; if with the second sound, it is probably aortic regurgitant.

Clinical Import of Cardiac Murmurs.

A murmur or morbid sound is not limited to any definite spot over the area of the heart, but its diagnostic value depends upon the place at which its intensity is greatest. Murmurs heard during the *systole* are due to the passage of blood out of a ventricle, and is almost synchronous with the pulse at the wrist. These murmurs are *sometimes functional* or *temporary*, and significant of impoverishment of the blood, or of coagulation of blood in the heart's cavities. These systolic or inorganic murmurs are soft and gently

flowing, and usually best heard over the pulmonary orifice, at the second left or "pulmonary" cartilage. Murmurs *due to coagulation of blood* are most common on the right side of the heart. This *intra-cardiac thrombosis* is liable to occur as a very serious complication in rheumatic fever, croup, and pneumonia. Extension of percussion, dullness to the *right*, and irregular action of the heart with the morbid sound, mark the event.

Murmurs heard during the *diastole* are due to the passage of blood into a ventricle, and they *always indicate structural disease*, such as surface roughness, fissuring, and lymph deposits, if *obstructive;* while those of regurgitant character may be traced to intertwined lymph impeding the play of the tendinous cords and papillary muscles, atheromatous degeneration, or calcification. An endocardial murmur early developed, under observation during an acute attack, is pretty good evidence of endocarditis, and, if it persist all through the acute attack of disease, it will probably remain as a permanent condition; if some months afterward it is inaudible, owing to weak action of the heart, a little extra exertion on the part of the patient, by exciting the heart, will soon show whether or not it is still present. *Recent endocardial murmurs* of soft tone may disappear after two or three weeks. This result is due to the absorption of a recent lymph exudation on one of the cups of the mitral valve. If an *aortic constriction murmur* is accompanied by a pulse regular in force and rhythm, but small, hard, and prolonged, it indicates that there is some hypertrophy of the left ventricle, forcing the blood powerfully into the arteries through the obstruction at the seat of the aortic valves. *Mitral regurgitation* is commonly associated with dilated hypertrophy of the left ventricle. The stress of mischief falls on the pulmonary circulation, the sequence being cough, with watery expectoration, dyspnœa, pulmonary œdema, and apoplexy, especially if the condition is much prolonged. The systemic circulation is not soon affected, and *dropsy* does not result, unless the dilatation of the heart has become general. Eventually the *liver* and *kidneys* are liable to congestion, and, if the heart becomes much dilated, we may find albumen in the urine. *Aortic valve insufficiency* is known by the presence of a *diastolic murmur*, loud and of maximum intensity, over the greater part of the sternum; but, owing to roughness of the aortic valves, a *regurgitant* murmur is also usually heard during the first sound. The rhythm of this murmur is appreciated by applying the finger over the subclavian or carotid artery during auscultation. Owing to the reflux of blood during the diastole into the left ventricle, this cavity tends to enlarge and elongate, so that the visible apex-beat is carried downward and to the left. The murmur, however, is usually louder at the ensiform cartilage than at the apex of the heart. It is accompanied with a jerking, radial pulse, which rapidly recedes from the finger, and is usually *visible*, especially when the arm is elevated.

It is now known that certain cardiac murmurs, dependent on definite organic lesions, change and vary, and frequently disappear, the lesion still remaining. Not only is this true of incurable cardiac disease, but the no less important fact is ascertained that many murmurs, apparently due to an incurable lesion, may actually depend upon morbid conditions which are perfectly curable, and in which, therefore, the murmur may not only disappear, but also the heart itself become perfectly normal. It is now an undisputed fact that, even after a considerable degree of regurgitation, either through the mitral or tricuspid valves, complete restoration to the normal condition of these valves may actually take place; and the same may be affirmed, but to a much more limited extent, of the aortic valve. Whether this restoration to the normal condition becomes permanent or not depends upon a variety of circumstances, more especially on the original cause of the lesion, the age, the occupation, and mode of life of the patient. It is thought—since anæmia, chlorosis, etc., as well as general febrile conditions, induce muscular relaxation and general debility—that the muscular substance of the heart is affected in a like manner; for, after death in these cases, it has been found flabby and relaxed; and, in well-marked cases of chlorosis, even dilated (from loss of elasticity) and

somewhat hypertrophied. It is also probable that the *so-called functional* or *hæmic* murmurs, so constantly heard in chlorosis, etc., are due not merely to an impoverished condition of the blood, as was formerly thought, but to actual regurgitation, brought about by the relaxed and dilated condition of the heart itself, due to malnutrition. This condition, if not too far advanced, is curable. Appropriate treatment not only restores the heart to its normal condition, but causes the accompanying murmurs to disappear. *These cardiac hæmic murmurs are always systolic in rhythm*, and, when they exist, are heard with maximum intensity about one inch and a half to the left of the pulmonary area, and in the same plane—i. e., just over the position of the left auricular appendix. *The presystolic murmur of mitral stenosis*, the most typical of all murmurs, occasionally disappears, the lesion still remaining. *Mitral regurgitant murmurs*, when due to simple relaxation of the heart's muscle and dilatation of its cavities and orifices, as in chlorosis and general febrile conditions, in most cases completely disappear under appropriate treatment. *Tricuspid regurgitation* is occasionally a temporary condition, due to bronchitis, etc., and, when the cause is removed, this condition is recovered from, as is indicated by the disappearance of the murmur. *Aortic systolic murmurs*, due to permanent lesion at the aortic orifice, may undergo changes in their intensity, but never completely disappear. *Aortic diastolic murmurs*, in certain extremely rare cases, have been known to disappear. In these cases a systolic aortic *bruit* is always present, which remains persistent, and thus indicates the existence of the lesion. *Pulmonary systolic murmurs* are persistent *when due to an organic lesion*, but otherwise may disappear temporarily or permanently.

It is to be remembered, in view of the foregoing facts, that, in forming a correct diagnosis and prognosis of any given case, too much reliance is not to be placed on the presence or absence of murmurs. Although they are among the most constant of the physical signs of heart disease, still their presence does not necessarily indicate the existence of incurable lesions, nor their absence that such lesions are not present. An accurate opinion requires that other signs and symptoms receive careful consideration.

Audible Signs referable to Vessels.

A *bellows murmur* over an aneurismal tumor is of frequent but by no means of constant occurrence. Aneurismal murmurs are either single or double. If single, they accompany the first sound of the heart (systolic), and both sounds, if double—the diastolic murmur being caused by the recoil of the coats of the aneurism after dilatation from the influx of blood with the ventricular systole.

Pressure of tumors on the abdominal aorta may produce a double murmur. This sign is therefore no proof that it is aneurismal.

A systolic murmur over the aorta and pulmonic artery in the second intercostal space, on the right or left side, close to the sternum, is often a sign of impoverished blood. This blood disease causes murmurs in other arteries—namely, the carotid, subclavian, and femoral. A systolic murmur in the left subclavian artery is heard in some healthy persons; in these instances it is a normal peculiarity. A systolic murmur in the left infra-clavicular region is, therefore, not evidence of disease, if unattended by other morbid signs, and the presence of the murmur is not sufficient reason for refusing an application for life-insurance. An arterial hæmic murmur is generally soft, but is sometimes rough; hence, roughness of the murmur is not proof of its being organic—that is, dependent upon lesion of either the heart or arteries.

A communication between an artery and a vein (aneurismal varix) occasions a murmur, and often a thrill communicated to the touch.

Auscultation furnishes an important physical sign referable to the cervical veins, namely, the venous hum (*bruit de diable*). This is a continuous humming murmur, heard when the stethoscope is placed upon the neck posterior to the sterno-cleido-mastoid muscle, especially on the right side of the neck

the patient's head being rotated as much as possible to the left. That this murmur is produced by the current of blood in the veins, is demonstrated by placing the finger above the point at which the stethoscope is applied and making moderate pressure: the murmur is instantly arrested, and it returns directly the finger is removed. This murmur requires for its production an abnormal condition of the blood. It is a very constant sign in anæmia, and is important in the diagnosis of blood disease. The disappearance of the murmur is proof that the anæmic condition of the blood no longer exists.

Modes of Examining Patients.

"The exigencies of medical practice often require a speedy diagnosis with reference to immediate therapeutical indications. The mode of examination is, then, to seek at once, under the guidance of symptoms, for the seat and character of the disease. Pain, distress, or morbid sensations of some kind —in other words, subjective symptoms—generally give a correct direction to the examination. Certain manifest objective symptoms, such as lividity of the face, rapid or labored breathing, vomiting, cough, etc., may direct attention to the seat of the disease; but naturally the first question asked is, 'From what do you suffer, or what are your ailments?' The diagnosis is based on the interpretation of the subjective symptoms educed by these and other questions, together with the information obtained by interrogating, as far as practicable, the organ, or organs, prominently affected. In judging of therapeutical indications, certain general symptoms are to be taken into account, more especially those referable to the circulation and the temperature of the body. This mode of examination is allowable on the ground of the necessity of haste. As soon as practicable, the examination should be made complete, by extending it over the whole body, and obtaining all important details belonging to the previous history of the case. Owing to neglect in this regard, not unfrequently grave affections are overlooked. As illustrations of this statement, certain gastric symptoms may be considered as merely evidence of functional disorder of the stomach, when they are dependent on carcinoma of this organ, or on disease of the kidneys; and a patient may be supposed to be affected with only dyspepsia, latent intermittent fever, or general debility, who has chronic pleurisy, with large effusion. In some cases a prompt diagnosis is desirable when the condition of the patient precludes any aid from subjective symptoms. A patient in the state of coma may be seen by a physician for the first time, and he may be unable to obtain any account of the previous health or the circumstances preceding this state. Now, coma may proceed from either active hyperæmia of the brain, extravasation of blood within the skull, embolism, uræmia, alcoholism, an epileptic paroxysm, narcotism, hysteria, *coup de soleil*, nervous exhaustion, or an injury of the head. It may be highly important to determine, without delay if possible, which one of these several conditions exists. The diagnosis must, of course, be based exclusively on objective symptoms."

"The prognosis and the treatment hinge upon the diagnosis, which is likely to be correct in proportion to the knowledge and skill of the physician. Other things being equal, the risk of making an imperfect or erroneous diagnosis is in proportion to the rapidity and incompleteness of the examination; but, under certain circumstances, the treatment must be based upon a provisional diagnosis. Indeed, in some cases, the urgency of the therapeutical indications calls for active measures of treatment before it is possible to reach a definite diagnosis. If the entire history of a case can not be obtained at a single visit, and especially if the patient betrays signs of weariness, it is better to postpone further inquiries until the following day." Much harm may be done by an untimely or a protracted examination. The study of a case of disease comprises the inspection and the interrogation of a patient. The first of these is performed by the physician alone, and comprehends a minute survey of all the external physical characters of the patient. The second requires the concurrence of the patient (who may be more or less

is useful, whether the cases be recorded or not, the object being to interrogate all parts of the body sufficiently to ascertain whatever important symptomatic phenomena may be present, and also to exclude those which are not present. Without these positive and negative facts, a case has not been fully investigated, and the diagnosis will likely be defective or erroneous if in the examination any one of the different *physiological systems* be overlooked or insufficiently interrogated.

In conference with the sick, the plainest language should be employed, to the complete exclusion of all technical terms; to use the latter is a miserable affectation, of which few are guilty besides those who think it of more consequence, by high-sounding phrases, to gain a reputation for wisdom than to deserve it by a profound study of disease. It sometimes happens that a patient, in replying to learned questions which he does not understand, in emulation of his interrogator, makes use of words absolutely without meaning, and thus the whole inquisition becomes supremely ridiculous. It is often quite impossible to extract a sensible answer from an uneducated man, unless he feels at liberty to employ the idiom he is most accustomed to. A physician has to learn by experience the meaning of many strange expressions used by certain classes, and especially by foreigners, for in these terms alone is the patient able to communicate an idea of his sensations.

Again, the young practitioner should be forewarned that there are many persons, even among the educated classes, who grow very restive and impatient under the examination which is here insisted upon, for they can not comprehend why so close a scrutiny should be necessary, when certain popular practitioners form their opinions apparently from little more than inspecting the tongue and feeling the pulse. They imagine, and not without some plausibility, that the ignorance of the physician must be in proportion to the number of questions he asks; they conceive that it is his business to inform them, and not they him. "Nothing is so humiliating to a just pride as depreciation of the very qualities or attainments on which a claim to merit is founded, and any one who addresses himself to the arduous task of investigating disease must expect such mortification in the early part of his career. But, if he wisely prefers being *thought* incompetent to being so in reality, he will rarely fail in overcoming prejudice at last, and of receiving the applause to which he is justly entitled." But it is not pretended that every case should be subjected to rigid analysis; there are many which demand no such process that they may be prescribed for intelligently. Oftentimes, where a speedy diagnosis is desirable, the order in which symptomatic phenomena, belonging to the different systems severally, are noted is not of importance, and it is better to take up first the physiological system to which the symptoms point as the seat of the disease or of its most prominent manifestations, and to interrogate no further without sufficient reason. Again, in urgent cases, the first question should be directed to ascertain the seat of suffering. In local diseases this will usually be the region of the affected organ. In fevers and other general diseases the most painful part is often that in which there is the greatest danger of complications. All of the symptoms furnished by the affected part are first to be noted, and then each system and its functions claim attention in their turn; but all the particulars relating to each should be exhausted before entering upon the examination of another system or apparatus, so that no details of importance may be overlooked in the event that we consider a thorough investigation necessary. The examination of patients should not be made in the presence of disinterested spectators. "A full investigation involves points of inquiry which are among the confidential communications from the patient to the physician." Delicacy may prohibit a very free and direct mode of inquiry in regard to many diseases of females, and especially those of an age which should be preserved unsullied by the slightest breath of impurity. In such cases all communications should be made through an elderly person of the same sex, the mother, or some near relative of the patient. In cases of extreme gravity, certain questions are liable to excite the apprehensions of the patient

and hasten the fatal result of his disease, even if they do not sometimes turn the balance against him. The implicit confidence of a patient in his physician is certainly a tribute to be coveted by every man of feeling, but is one susceptible of the most cruel abuse. The slightest word of encouragement will sometimes rouse the energies and cheer the drooping spirits of the sick; hence, every remark or question which even insinuates the incurable nature of the patient's malady should be so indirectly made and so carefully guarded as to excite neither suspicion nor dread.

Diagnosis of Disease.

Diagnosis may be defined as the art of recognizing the presence of disease, and of distinguishing different diseases from one another. The term is also applied to the result obtained.

Objects of Diagnosis.—"In many respects diagnosis is a subject of great interest and importance. First, in a scientific point of view, it is essential that all knowledge should be accurate. Secondly, accuracy of diagnosis, founded upon a sound pathology, enables us to frame a scientific classification of disease in its diverse forms. It is also by accurate determination of the nature of disease which may be present in any given case that we are able to anticipate its course, and to employ the right kind of remedies in its treatment. It is imperfection of diagnosis which leads in many instances to an under-estimate of the value of therapeutical agents; for, when the nature of a disease is mistaken, we are led to employ improper and unsuitable remedies, the failure of which is then erroneously attributed to the inefficiency of the agents, and not to the unfitness of the treatment employed. If our diagnosis had been correct or complete, the remedy selected would more often have had the desired effect."

Difficulties of Diagnosis.—It need scarcely be said in this connection that the practice of diagnosis is not free from great difficulties. We know (says Quain) how hard it is to obtain in ordinary daily life a reliable account or description of any past or present event. There must be still greater difficulty in obtaining an accurate medical history of a patient's case. He has to tell of facts of which practically he may know much, but scientifically very little. He may be forgetful or ignorant on points about which we most need to be informed. He may be inclined to exaggerate or to suppress facts of material import. Nor are the difficulties less in regard to the *objective phenomena* with which we have to deal. The symptoms of a disease are rarely so clear and definite as to mark its nature—that is, to be *pathognomonic.* They are more often slight, undefined, obscure, and to be found with difficulty. The symptoms of one disease may very closely resemble those of another, while those of the same disease will vary at different stages and in different individuals. Again, the symptoms of a disease may be complicated by the co-existence of those of another disease, while a symptom sufficiently striking in itself may be common to and present in several different diseases. We need only mention, for example, feverishness, pain, cough, dyspnœa, and blood-spitting. These are some of the difficulties which he who has to study the operation of disease in life has to contend with. The physician must, therefore, be well prepared for this duty, with a knowledge of the body, its structure and functions in health, and with a knowledge, too, of those combinations of morbid actions which constitute special forms of disease. For, as regards his latter knowledge, all the observations made would remain as isolated phenomena if they could not in each case be grouped as constituting distinct diseases. We have thus indicated the difficulties of obtaining accurate knowledge as regards both the subjective and the objective phenomena. The difficulties are not less when the exercise of the intellectual and reasoning faculties is called upon to analyze, to compare, and to group these phenomena.

Sources of Error in Diagnosis.—"Errors in diagnosis may have their source in the difficulties inherent in this branch of clinical medicine. Since problems arise which are by no means easily solved, the most skillful

experienced are liable to fall into error." Under this heading, Flint says, were any one to assume infallibility in this regard, the assumption, if honest, would be proof of inability to discover mistakes, and, therefore, of ignorance. "The more one believes in the possibility of error, the surer he will be to avoid mistakes." It can not be otherwise than that errors should be committed by those whose acquaintance with pathological laws and the clinical histories of diseases is limited. Other things being equal, one is the less likely to commit errors the greater his familiarity with symptoms, and the more accurate his appreciation of their relative diagnostic value. Thus practical knowledge is essential for recognizing the direct evidence of diseases, the exclusion of other diseases, and the points involved in differential diagnosis. With reference to the requirements under this head, the practice of recording cases can not be too strongly recommended. Errors are apt to spring from precipitancy in arriving at a diagnosis. A conclusion is formed after a few facts only have been ascertained. The mind is then in the attitude of seeking for proof to sustain a premature conviction. In other words, the diagnosis is made by guessing, the subsequent investigation, if not omitted as unnecessary, having for its object to confirm the guess. The practice of diagnosticating diseases by a glance, or after a cursory examination, is to be reprehended. It is a temptation of egotism to exhibit a remarkable ability of insight in this regard, but it is certain to lead to mistakes. Careful examination and deliberation before reaching a conclusion are in no sense derogatory, but they are, on the contrary, the attributes of a philosophic mind, showing, moreover, a due appreciation of the importance of the object; and, whenever the problem involves difficulty, the judgment should be held in abeyance until all available facts have been ascertained. The judgment is apt to be affected by the mental temperament. Some physicians are prone to strive for a conclusion which is most desirable. Their minds are biased by the hopes which their sympathy with patients leads them to feel, and by a tendency to look upon the bright side. Others are influenced by their fears, and an equal amount of sympathy leads them to look upon the darkest side. In order to avoid errors, the judgment should be exercised, as far as possible, independently of the sentiments. It is owing to the influence of the feelings upon the judgment that physicians are often incompetent to form correct opinions in diseases affecting themselves, their families, or intimate friends.

Methods in Diagnosis.—"There are three methods in diagnosis—namely, the direct, the indirect, and the differential method. These three methods are frequently employed in combination. Observers can sometimes arrive at a *direct diagnosis* when aided by the presence of some characteristic symptom or sign of disease. The diagnosis is direct when it is based on pathognomonic phenomena, or an amount of diagnostic evidence sufficient to warrant at once a positive conclusion. A symptom or sign is pathognomonic when it very rarely if ever occurs if a certain disease be not present. The rusty expectoration which is characteristic of pneumonia is a pathognomonic symptom, and the crepitant *râle* is a pathognomonic physical sign.

"The diagnostic evidence which different symptoms and signs afford is great in proportion as the number of diseases in which they occur is small. Hæmoptysis, for example, is highly diagnostic of phthisis, because it occurs so infrequently in other affections. It is not, however, pathognomonic, for it does occur in several pathological connections.

"An *indirect* diagnosis is made by what is commonly known as the method of exclusion. Diseases liable to be confounded with the one actually existing are excluded by the absence of symptoms or signs which should be present if they existed. By being able thus to trace the absence or the presence of a given symptom, we may be able to exclude the possibility of the existence of one or other of the diseases under investigation. By this method the [di]agnostic problem may often be reduced to the inquiry, which one of a few [dis]eases exists, and sometimes, reasoning from negative facts, the conclusion [is a]lmost as positive as if it were based on direct evidence.

"A diagnosis is made by the differential method when the problem is to decide between a few diseases, and a decision is to be reached by canvassing fairly the evidence for and against each. Thus, when diseases which are essentially different have symptoms more or less common to both, the physician will have to institute a *comparison* between them until he finds sufficient evidence in the presence or absence of some distinctive symptom or sign to satisfy him as to the nature of the disease which is present.

"Of these three methods, the direct has priority in rank, and is to be first employed in diagnosticating disease. The indirect method is second in importance, and is to be made available whenever the direct method is not adequate for a positive diagnosis. The differential method is to be resorted to when a conclusion is not warranted by the other two methods."

The physician may commence his inquiry by tracing up the history of the case and its several incidents, a method which is called the *synthetical ;* or he may commence by ascertaining the present condition of the patient and going, as it were, backward in his inquiry, a method which is known as the *analytical.* As a general rule, both methods are combined in the practice of diagnosis. In forming a diagnosis in any particular case, Quain remarks that the physician must, as far as possible, keep in view the real or the ideal condition of the patient in a state of health. He must endeavor to place him in as natural a position as may be, and as little disturbed by the presence of his attendant or by external circumstances as possible. Then, by observing and comparing the abnormal changes in the function and structure of the several organs of the body, the presence and the nature of disease may be discovered and determined. In conclusion, it must be remembered that these investigations, which call for the exercise of the highest mental faculties, should be conducted without prejudice and without haste. We should never be ready to accept as clear that which is obscure, as established that which is open to question ; above all, we should remember that, though "to err is human," it is our duty to endeavor to ascertain in each and every case, before commencing its treatment, what its real nature is as far as may be possible. It can not be too often repeated that the application of a right remedy depends on an accurate diagnosis, and that the prevention and cure of disease are the aims and ultimate objects of our science.

PROGNOSIS OF DISEASE.

Prognosis is the art of forecasting the course, events, and termination of any given case of disease. The term is also applied to the foreknowledge thus obtained.

General Considerations.—"It is a matter of interest, and often of great importance, to be able to indicate with precision how a case of disease or of injury will be likely to advance and terminate. This question must be always present to the physician's mind, and it can rarely be absent from that of the patient and of those who are interested in his well-being." Prognosis is, in one sense, essential to the treatment of disease, as it may relate to future dangers demanding extraordinary measures for their prevention, if possible; while its incidental value may be very great, inasmuch as it affects the domestic and civil relations of the patient, inspiring him with a hope of recovery, or, by assuring him of the impossibility of such an event, disposes him to make those preparations for his change which religion enjoins and affection demands. Upon no other subject is the opinion of the physician so often required. It makes but little difference to the patient whether his malady is of one nature or another, or is called by one or another name, except in so far as a knowledge of its name and nature gives him some notion of its gravity, duration, and probable ending. The physician is mostly concerned with the present; the patient looks constantly to the future. All questions that the former asks relate to what has happened or is taking place; all the inquiries of the latter relate to what he may expect to suffer or escape. From the very commencement of the attack the friends

patient are less concerned to know his disease than the probable duration of his confinement; and some opinion upon this point the physician can scarcely avoid expressing.

It can easily be seen how much depends upon the answer of the physician to the questions constantly proposed to him: How long is this illness likely to last? How is it likely to terminate? If in recovery, will the recovery be complete or partial? If in death, when and how? In proportion to the positiveness of his prognosis, and the accordance with it of the result of the attack, is the honor in which he is held, and certainly with good reason, if his opinion has been anything more than a lucky guess.

Grounds of Prognosis.—"The knowledge which can give trustworthy answers to such questions as the preceding must be founded upon an accurate diagnosis of the nature of the disease from which the individual is suffering, upon the capability of remedies to control it, upon external influences modifying both of the foregoing, and, lastly, upon an estimate of the constitutional and vital powers of the patient.

"First, as regards the *nature of the disease*, important prognostic evidence may be obtained. Some diseases which are mild in their nature run a definite course and end favorably; take, for example, a simple catarrh. Others commence with great intensity, and come to a favorable or unfavorable termination very rapidly—for instance, Asiatic cholera, of which many of the subjects die in less than twenty-four hours from the time of their first becoming manifestly ill. A third group, such as typhoid fever and certain of the exanthemata, run a longer and more defined course, seldom terminating in death except after the lapse of many days, nor in recovery except after a period of some weeks. Another class of maladies, chronic in character, rarely acute—such as we see in tubercular diseases of the lungs—render the patient more or less an invalid so long as he lives, and generally end fatally. The like observation will apply to the so-called malignant diseases." Again, neuroses, or functional nervous disorders, are essentially less dangerous than inflammatory diseases, and inflammations less so than gangrene or an organic affection.

"The *intensity of the particular attack* affords further grounds for prognosticating the result. Thus, in a fever, great prostration, high temperature, and a rapid pulse, indicative of the severity of the disease, must lead to the formation of an unfavorable prognosis, just as great debility and wasting, with disturbance of nutritive functions generally, would indicate a like result in chronic diseases." The *mode* in which an attack of sickness *commences*, especially during the prevalence of an epidemic, is not without significance. The severity of the initial symptoms is then a pretty fair index of the subsequent gravity of the disorder. At other times the symptoms of invasion are of very uncertain value in prognosis. Many attacks of variola of the mildest type commence with as violent reaction as those of the confluent variety, and, after two or three days of high fever, intense headache, and perhaps delirium, the eruption appears, and thenceforth the disease runs gently on toward a cure. But, on the contrary, many attacks of sickness are so mild at the commencement as to excite no apprehension whatever, and yet daily grow worse and worse until all hope of curing them is lost.

The *seat* of a *disease* is of capital importance in prognosis. It is clear that the more essential to life is the organ attacked, the greater will be the danger; hence, in local diseases or complications, whatever the nature of the disease may be, the *organ affected* must form an important element in prognosis. Affections of the brain, the heart, or the lungs are infinitely graver than those of the liver, the spleen, or the limbs. So, too, portions of a vital organ most essential to its functions are most apt to endanger life when diseased. Affections of the pons varolii and of the crura cerebri are more rapidly fatal than those of the hemispheres, because they are in more immediate connection with the nerves by whose action life is maintained; for a [illegible]lar reason, lesions of the cervical portions of the spinal cord involve [illegible]r danger than those of the inferior divisions. Valvular disease of the

heart is more serious than corresponding alterations in other parts of this organ.

Course of Disease.—"Certain maladies, among which may be mentioned eruptive fevers and acute inflammations, are, for the most part, regular in their course, the symptoms succeeding one another in an established order. Hence, any marked departure from their accustomed course must be interpreted as unfavorable to their cure. It usually indicates some serious but latent complication, which interrupts the natural progress of the attack. If the disease proceeds without amendment beyond the period when it should begin to decline, or when, from the commencement, the graver symptoms assume an unusual severity, there is reason to apprehend the worst. An opposite interpretation, it is plain, should be given to the unusual duration of diseases in their nature incurable, or which require for their cure a considerable lapse of time; in them every day added to the disease is one gained by the patient. If the patient has on former occasions experienced the same disease as that for which he is under treatment, a knowledge of any peculiarities it may then have presented will aid materially in forming an opinion in regard to its present course and probable issue, and of the importance of those peculiarities should they again appear.

"Although, as a general rule, the longer disease continues the more unfavorable the prognosis, yet there are some exceptional cases besides those already mentioned of incurable affections. In certain acute disorders which are apt to be fatal within a limited period, their prolongation beyond that point is favorable. Thus it has been found that in epidemic cholera the proportion of cures after twelve hours is as one to three, but that after twenty-four hours it is as two to one, after two days three to one, and after three days four to one. In other words, the longer the attack the greater the hope of its cure. It is probable that this proposition holds in regard to all epidemic disorders.

"*Causes of disease* are not in general of much value in prognosis, yet they are sometimes of great importance in this connection. Thus inflammation of the peritonæum has a very different degree of gravity according as it is idiopathic or tubercular, or produced by perforation of the intestine or some other abdominal viscus, or occurs immediately after parturition. Tetanus of traumatic origin is infinitely more dangerous than when it arises from exposure to cold. A bubo proceeding from syphilitic infection will suggest a very different prognosis from one caused by an excoriation of the heel.

"Certain elements of prognosis are derived almost exclusively from the *general symptoms.* They consist of particular symptoms supposed within themselves to be of good or evil augury, and quite independent of the disease in which they occur. Such are extreme debility or emaciation, the Hippocratic countenance, great frequency or irregularity of the pulse, great extremes of temperature, fetid exhalations from the skin, colliquative diarrhœa, etc.

"Other symptoms which are chiefly local and discoverable by the several methods of *physical* exploration are of great prognostic value. By these means it is frequently possible to ascertain the existence of organic disease where the general symptoms give no indication of peculiar danger. This is especially true of diseases of the heart, of aneurisms of the aorta, and sometimes of pulmonary tubercles. The same methods often show whether a more or less dangerous lesion exists in a given case. For example, palpation enables us to distinguish between cancerous and other enlargements of the liver; chemical tests applied to the urine indicate, under certain circumstances, whether renal disorder is attributable to Bright's disease, which is incurable, or to some other affection, which may terminate in recovery. In a word, the prognosis in these cases depends wholly upon the accuracy of the diagnosis. If the latter be doubtful, the former will necessarily be uncertain; but if the diagnosis be well established, the ultimate termination of the disease may be confidently predicted, for the diseases to which allusions h[illegible] here been chiefly made are all, as a rule, beyond the power of medical a[illegible] cure, however much it may prolong their course by palliative treatment

"The *complications* of a disease render its prognosis unfavorable. Thus articular rheumatism, when simple, proceeds steadily toward a cure; but when complicated with pleurisy, or more particularly with peri- or endo-carditis, or involvement of the cerebral meninges, it is very apt to have a fatal termination, or to result in permanent unsoundness of the heart. Inflammation of the lungs and affections of the brain are of frequent occurrence in eruptive and other continued fevers, and uniformly aggravate the situation of the patient."

Constitution, Age, and Sex of Patient.—"It may be safely anticipated that in a patient with a good constitution the prognosis will be more favorable than in a person of a feeble or broken-down constitution. Persons whose vital powers are unimpaired will resist disease and recover under circumstances which would be fatal to other individuals in whom, on the one hand, plethoric habits may predispose to acute and rapid changes, or who, on the other hand, by degeneration of tissues, may be rendered liable to succumb, and that rapidly, to morbid influences which healthier textures could resist and overcome." In this connection it may be stated that the *hereditary tendency* of a patient to the disease under which he labors must nearly always render its prognosis unfavorable, for it indicates a constitutional proclivity to such disease which medical treatment can rarely arrest, although it may succeed in relieving the individual attacks, even of such hereditary diseases as proceed steadily to a fatal issue. The different forms of insanity, epilepsy, and other nervous disorders, phthisis and scrofula, rarely admit of a perfect cure under these circumstances.

Much depends upon the disposition of a patient and his habitual cheerfulness or dejection. Many bear pain with fortitude, become resigned to the prospect of a long confinement and the interruption of their ordinary pursuits, and are gay and hopeful in the midst of imminent perils. Others no sooner fall sick than they grow peevish, irritable, unreasonable, and impatient of restraint; they are disposed to brood over the evils of their situation and to entertain the most gloomy apprehensions. It is apparent that the same disease must affect these two classes of persons very unequally—that it will very probably fail to exhaust the good spirits of the former, and will acquire additional gravity from the despondency of the latter.

Habits and occupation are not without influence upon the character of diseases. It is a familiar fact that drunkards are among the easiest victims of disease. They readily succumb under injuries and surgical operations, and during severe epidemics very few of them escape alive; though there are exceptions to this rule—cases in which intemperance seems to produce insensibility and a power of passing unscathed through the severest trials of the constitution. But, in the large majority of instances, habitual indulgence in alcoholic drinks creates an inability either to resist disease or to sustain medical treatment. All other debilitating causes have a like effect, such as prolonged abstinence, overfatigue, loss of sleep, long-continued overwork, mental or physical, and venereal excesses. Disease is badly borne by the very young and the very old. In very young children, disease rapidly runs its course favorably or unfavorably. The aged have but little power of reaction or of resistance, and disease in them, though less pronounced, more frequently ends unfavorably. In middle life, disease may be expected to assume an acute or sthenic form.

"As a rule, sex has little influence on the prognosis of disease, except that usually diseases of equal severity are more amenable to treatment in females than in males. Nervous symptoms are, however, more easily developed in women, exaggerating a condition that might not otherwise be unfavorable. Menstruation, pregnancy, parturition, and lactation have all a certain amount of influence, sometimes favorable and sometimes the reverse, on diseases in the female.

"*With respect to treatment*, a more or less favorable prognosis may be [...]nded upon the fact that the patient can enjoy all the advantages afforded [...] rest, diet, change of climate, proper nursing, and other aids incident to

their social condition, which may not be available under other circumstances for like cases. The poorer classes—those that do not possess even the comforts of life and at the same time furnish the greatest number of instances of vice—suffer most heavily from disease. It is well known that there are remedies that exert a controlling if not a specific effect upon certain diseases, as quinine upon malarial fever, mercury in some forms of syphilis, iodide of potassium in certain stages of the same disease, arsenic in some chronic diseases of the skin and certain neurosal affections, and salicylic acid in rheumatism. In such cases a much more favorable prognosis can, of course, be given than in those for which no such remedies are known to exist. Experience tells us that favorable results follow in many other cases in which suitable though not actually specific remedies can be applied. Taking in consideration, then, the foregoing conditions, the nature, the intensity, the seat, and the complications of the disease, the constitution, the resisting power, the age and the sex of the patient, and the possibility of applying suitable and efficient remedies, we are able, in a large number of cases, to arrive at an accurate conclusion as to what the course and result of a disease will be."

Difficulties of Prognosis.—Still, to arrive at an accurate prognosis is often very difficult; for, if diagnosis be difficult and therapeutics uncertain, prognosis is both, and in a twofold degree. That it is found to be so in practice is shown by the extreme wariness and hesitation of men of much experience in predicting the issue of disease, and the readiness and confidence of young and ignorant practitioners in foretelling the event of every affection they have to treat. A scientific prognosis should be founded on diagnosis; the disease under observation must be first accurately made out before anything can be predicted of it with tolerable certainty, at least during its stage of increase. Yet prognosis demands a greater skill and experience than diagnosis, for often it is very easy to determine the nature of a disease, but quite impossible to foresee its termination, because one that is mild in the beginning may during its course become violent or malignant. No human sagacity can always anticipate the numberless influences for good or for evil which may come into play, increasing the activity of a disease or causing its extension to an important organ, or changing its type from one capable of supporting an active treatment to one in which no treatment will be serviceable. While it is evident that, other things being equal, the danger of a disease is in proportion to its magnitude, in physical extent and in the development of its symptoms, yet there are often apparent exceptions to this plain proposition. The concomitant circumstances may really be very different in two apparently similar cases, and thus may be explained the fatal termination of the one and the recovery of the other when the mere extent and intensity of the disease seemed to be the same in both. "But disease is not always identical in its character, nor definite in its progress or results. The constitutions of individuals vary, and it is often very difficult to measure their powers of resistance. Remedies, too, vary in their action and their operation, and sometimes we are deceived in the best-founded conclusions as to the results they will accomplish. There are few physicians who can not recount the errors of prognosis made by themselves or by their colleagues. Many persons now live who had been doomed to die, and many persons have died whose death was not anticipated. It is the duty of the physician, when asked for his opinion, to state it honestly, but with great discretion, and, in general, with as much hope as is fairly admissible. He must be guarded in the manner in which his view is communicated to his patient, for there are many individuals whose temperament is such that the progress of their disease would be greatly influenced for good or for evil by the expression of a favorable or an unfavorable opinion. At the same time the physician must avoid deceit, and, if there be risk or danger in communicating an unfavorable prognosis to the patient, he must at least communicate it to some judicious individual among the patient's friends. Altogether, too much caution can not be exercised in stating in any obscure case what its progress and results will be. There are many cases in which the medical attendant will be justified in replyi

he is a physician and not a prophet. He can not always foretell results, his aim and object ever being to mitigate the patient's suffering, to prolong life, and to cure the disease if possible; often to do more than this is beyond his art." But an advantage older physicians have over younger ones is increased ability to foresee the probable degree and duration of grave cases, and to give concerning them truer opinions from the beginning. They can from experience point out cases that are dubious or likely to prove very slow and tedious, thereby saving themselves from much anxiety and blame. Such advantages, of course, advance them in reputation and enable them to carry cases and retain confidence much better than younger physicians; and this is the chief reason why the practice of medicine becomes easier and more satisfactory after a physician has had the advantage of a few years of clinical experience.

The public like to see a doctor appear to know things intuitively, and it is to his interest to study and practice to be quick in prognosis as well as in diagnosis, and ever ready in the treatment of the ordinary cases that will constitute nine tenths of his practice. "The physician, however, should never be too sanguine of a patient's recovery from a serious affliction, and never give one up to die in acute disease unless dissolution is actually in progress; and, above all, he should never withdraw from a case of acute self-limiting disease because the patient is very ill. He should be ever fertile in expedients and in the use of remedies, never admitting that he has exhausted his resources and that nothing more can be done. Even after a patient is unable to swallow, or if food be taken into the stomach and is unassimilated, if the physician considers his own interest, as well as that of the patient, he will continue his efforts with inunctions of cod-liver oil, glycerine and quinine, rectal alimentation, etc., until the patient is either better or the breath is out of the body, for *nature*, by crisis, or a vicarious function, or a compensatory process, may turn the scale and let the life-power rally and gain control over the disease at the last moment. In all such cases, had the medical attendant given the patient up, he would have been disgraced, while some other doctor, or a homœopath, or an old woman who had slipped in, would get all the glory."

Patients are entitled to all the encouragement which can conscientiously be given. In this point of view there is a marked contrast in the conduct of different physicians. Some, who are unfortunately disposed to look upon the darkest side, anticipating the most unfavorable events that can happen, communicate their apprehensions and gloomy forebodings either by words or manner; while others show by their appearance a lack of confidence in themselves, or, still more, a lack of confidence in the remedies they employ —fatal defects in the character of any physician that will not escape the keen scrutiny of an anxious patient. The discouraging influence thus engendered upon the minds of patients is often baneful. "It is often a duty to give the encouraging points in any case, and not to discourage by presenting prospective dangers, which are problematical. Cases which furnish an exception to the latter rule are those in which it may be necessary to alarm the patient in order to secure measures of protection against events which are liable to occur. For example, the effect of phthisis on the mind is such that sometimes patients insist upon the inutility of taking any steps to prevent the further progress of the disease. As a rule, whenever there is doubt as to the degree of existing danger, the patients should have the benefit of the doubt in the way of encouragement. In cases of disease threatening life, shall this fact be voluntarily communicated to patients, in order to give time for the disposition of worldly affairs and other preparations for death? With reference to this question the physician is often placed in a delicate and somewhat difficult position. It is rare for patients, with mental faculties intact, to ask of their own accord a direct question as to immediate danger. If asked, the physician is bound to answer without deception, but, if possible, with qualifications which will not take away all [illegible]. If not asked, it may be the duty of the physician to suggest that [illegible] friend of the patient communicate the fact of imminent danger. Pa-

tients, after becoming aware of danger and having made in view thereof every preparation, are sometimes more tranquil than before. Resignation at the approach of death is the rule; fear and dread of the termination of life, when encouragement can no longer be given, are rare exceptions to the rule. This does not militate against the beneficial influence of encouragement, so long as it can be given. In brief, knowledge of the character of the patient, and of all the circumstances in individual cases, in connection with the exercise of judgment and tact, must determine the conduct of the physician when diseases approach a fatal termination." It may be added that the visits of judicious clergymen are unobjectionable, either in the cases now referred to or when life is not immediately threatened.

"Physicians are most apt to be asked respecting danger when patients either imagine its existence or suppose that it does not exist. The usual mode of asking is not, 'Tell me candidly if I am in danger,' or 'What are the chances of my recovery?' but 'You do not think my case serious?' or 'You have no doubt of my recovery?' Most patients, who infer from circumstances that they are considered to be in great danger, prefer not to be told so in plain terms." If there be danger not proximate, but more or less remote, the answer to the foregoing questions should be such as to avoid deception, to secure any needed preparations, and at the same time not to withhold a proper degree of encouragement. "It is better to be prepared and not go than to go unprepared," is quoted by Dr. Flint as the happy reply of a medical friend of whom a patient inquired as to whether his condition was sufficiently serious for a final disposition of affairs.

"Intimations to patients of a liability to sudden death should be made with the greatest reserve. The cases are rare in which the physician is able to foresee this event with anything like certainty, and it is a cruel act to intimate the liability on insufficient ground. Instances of wretchedness for years are frequently caused by the belief that apoplexy might be expected at any time, and that death might occur at any moment in cases of purely functional disorders of the heart. Even in cases in which a liability can be recognized—as in cases of angina pectoris, fatty heart, and certain aortic lesions—the event may not occur for a long period, if the patient do not die with some intercurrent affection. In these cases the physician should inform some discreet friend of the patient of the recognized liability to sudden death. It is well, also, to make memoranda, which may be referred to, after sudden death has occurred, as a protection against the charge of either negligence or ignorance.

"Communications in respect to danger may often be made to relatives or intimate friends with less reserve than to patients. They are, however, to be made with discretion. If extremely discouraging, they are apt to be interpreted as taking away all hope. The patient is considered as 'given up.' The effect is demoralizing. Either further efforts are abandoned, or doubts arise concerning the propriety of the practice pursued, both telling against the welfare of the patient. The physician should bear in mind that in certain cases he may overestimate the danger. This may frequently happen with young infants, who have a wonderful amount of vitality; in such cases they should never be 'given up' until they are dead, and even then the physician ought to be very certain that they are dead. And at other periods of life, instances are not very infrequent of recovery when the condition seemed as hopeless as possible. All physicians of much experience can cite cases illustrative of this fact.

"Undertaking to predict that a patient will live a certain number of days, weeks, months, or years, is injudicious, to say the least. It is a hazardous undertaking as regards the sagacity of the physician, and may occasion mischief. Giving the percentage of the chances of death or recovery is also objectionable. It does not confer credit on the profession for healthy persons to be able to say that, in years past, they were pronounced incurable, and the time of death specified."

TREATMENT OF DISEASE.

The term treatment has reference to the means by which disease may be prevented, or its effects counteracted when it occurs. The former is known as prophylactic or preventive, the latter as remedial or curative.

Prophylactic or preventive treatment includes the avoidance of the known causes of disease, especially precautions in regard to contagion, means of disinfection, the influence of climate, and various measures relating to personal and public hygiene, to which allusion has already been made in discussing the causation of disease. It is therefore unnecessary to say more upon the subject in this place.

Curative or remedial treatment, otherwise known as *therapeutics*, which signifies the "science and art of healing," is that which belongs more immediately to the province of the physician, and which may now be considered with reference to its general points of practical interest.

"Therapeutics is the most essential part of medicine; for, although other parts of medical science are interesting to the practitioner, it is the cure of disease which the patient seeks. Therapeutics may be divided into two classes—therapeutics of fancy, and therapeutics of fact. In primitive times the imagination of physicians was busy with fancies regarding the nature, causes, and the cure of disease. Many of these fancies were of the most absurd and unreasonable character. In all ages of the world's history we have had the therapeutics of fancy and the therapeutics of fact running side by side, and in proportion as the latter has predominated has the treatment been improved. In order to cure disease with certainty, the practitioner must know what the nature of the disease is, and what the action of the remedies will be. When these are positively known, therapeutics becomes a science; but when either is uncertain, it is simply an art. Its principles may hereafter become a science, but its practice must always remain more or less an art, and be dependent for success upon the skill of individuals; for the symptoms which ought to indicate to the practitioner the nature of the disease may be wrongly interpreted by him, or, as it is usually termed, he may form a wrong diagnosis, and thus be led to apply wrong remedies. The idea in the practitioner's mind may correspond more or less exactly with the condition of the patient, or may not have the slightest resemblance to it, and it is only by careful comparison and experiment that their agreement can be ascertained. An absurd fancy of the practitioner will lead to an absurd treatment, and the therapeutic results will not be satisfactory.

Principles.—"Bearing in mind that disease is a deviation from health in the functions or component materials of the body, it must be remembered that there is in organized bodies a tendency to maintain their healthy function and structure, and, in case of disease or injury, to recur to it. This is especially manifest in the lower types of animals, which, when mutilated, are capable of resuming more or less completely their original form to the extent even of the restoration of parts that have been lost. In man and the higher animals this power of complete restoration is confined to the elementary cells and least complex structures of which the body consists; the more complex tissues are not reproduced, nor are lost parts restored. There is, however, in man, as in all organized beings, a tendency to rectify deviations from health and to restore the organization to its normal condition. To remove or subdue the causes of disease, and to aid this restorative power in the establishment of healthy function and structure, is, for the cure of disease, the most philosophical indication that can be adopted. But our knowledge of disease and of remedial agents is not sufficient to enable us always to carry out these principles. As the treatment of disease has sometimes been directed to the one object and sometimes to the other, frequently to neither, it has given origin to a great variety of systems or methods of practice. Thus, in the ear-
[illegible] history of the healing art, means the most diverse were used for the
[illegible] of suffering. Sometimes the suffering or the disease yielded while
means were being employed; and it was concluded, on very insufficient

grounds, that these agents had 'cured' the disease. Persons who had felt, as they supposed, the beneficial effects of these particular remedies, communicated them to others as the result of their experience, and thus was established what has been known in medicine as

Empiricism.—"This mode of practice has its advantages and its disadvantages. When aided by accurate knowledge and discrimination, it often leads to satisfactory results; and many remedies suggested by experience, and that alone, are now found to be in accord with our more advanced scientific knowledge." Take, for example, the use of mercury in syphilis, which, though long used empirically, is now known to act, by its control over the nutrition of young cellular growths, in rapidly inducing a fatty degeneration and elimination of the diseased cell-elements whose local and excessive proliferation, chiefly in the lymphatic spaces and vessels, constitute the essential feature of the disease. "So also with respect to quinine and other remedies of now established usefulness in special morbid conditions of the body. On the other hand, mere empiricism, when vaguely applied, taints and damages to this day the treatment of disease. It is this practice which, for example, suggests opium to quiet a cough or a colic without reference to the cause of the one or the other, and when an expectorant or a purgative would have been a suitable remedy; and it is this empiricism which does such harm in the hands of amateur practitioners, leading them to recommend for the relief of symptoms remedies which they supposed had relieved like symptoms in other cases, however different the real nature or causes of these symptoms may have been." Empiricism, it should be remembered, is the outgrowth of experimental therapeutics. Physicians in all ages have seen men suffering and dying all around them, and could not wait for exact knowledge. "They therefore applied themselves to tentative therapeutics, giving first one thing and then another, in the hope of doing good, and collecting the result of these experiments on these patients for the guidance of themselves and others in subsequent cases, the results thus obtained showing that a certain drug was useful in a certain disease *without the reason of this utility being known*, constituting *empirical* therapeutics. In order to obtain a broader basis than that afforded by the observations of any single man, some have collected numbers of cases from various observers, and have analyzed and tabulated them. The results of this method constitute *statistical* therapeutics. But it is liable to great fallacies, inasmuch as cases which are very different are tabulated for convenience' sake under the same name, and the results are therefore rendered untrustworthy."

Lauder Brunton remarks that the problem placed before the practitioner in the treatment of any one case is rendered exceedingly difficult, not only by reason of the complexity of the bodily mechanism itself, but by the manifold alterations to which it is subject in disease, and the variations produced in the action of a drug by alterations in dose, by differences in the original constitution of the patient, and further differences superinduced by the disease. So complex, indeed, is the problem that it is difficult to unravel it by any number of observations in disease, and it can only be solved by making ourselves acquainted with a few of the conditions at a time. This is preferably done by experiment upon animals, for human life is too valuable to allow the necessary sacrifice. In experimental physiology the functions of the various parts of the body, and their relations to each other, are being gradually ascertained; in experimental pathology, diseases are induced artificially in order that we may discover the alterations produced by them in the functions; and in experimental pharmacology, drugs are administered in order to determine the part of the body which they affect, and the nature of the alterations which they produce in its function. The problem being thus simplified, the practitioner may hope to recognize, from the symptoms of the patient, the organ affected by disease, the nature of the disturbance in its function, and to apply, with some degree of success, a remedy which will counteract such disturbance. This constitutes *rational* therapeutics.

Rational treatment differs from empiricism in that modern sci-

deavors to take cognizance of the nature of disease, and of the specific action of remedies it seeks to counteract—the operation of the one by the influence of the other. This includes not only the study of the nature of disease itself, its causes, and its effects, but also the study of the action of various agents on the living body in health and disease, and, if possible, to trace how far the one is capable of antagonizing and subduing the other. "This study of scientific therapeutics is of comparatively recent date, and is now pursued with great zeal. The results already arrived at are alike satisfactory and encouraging. As rational treatment becomes more firmly established, scientific medicine will take a more elevated and nobler position." But, notwithstanding great advances have been made of late years in this direction, it will be a long time yet before we can hope to obtain such exact knowledge as we desire, and at present our therapeutics must be, to a certain extent, empirical.

The *modes* or *methods* by which the two great principles just referred to (the foundations, as they are, of the healing art) have been applied are extremely various; and, although these different methods may be traced to the one or the other, they have received different names, according as they are marked by some special characteristic. When the treatment has been directed toward the removal of the cause of the disease, it has been called *pathogenetic* therapeutics. When this can not be recognized or can not be removed, the treatment is directed to those parts of the organism on which the cause of disease acts, so as to lessen or remove the symptoms which it would otherwise produce. This is *symptomatic* therapeutics. And when we can neither remove the cause nor relieve the symptoms by medicinal agents, but are forced to trust to the *vis medicatrix naturæ*, and try to maintain the patient's strength by food and nursing, etc., it may be called *hygienic* therapeutics. The different *modes* of treatment belonging to these general *methods* of most importance may be enumerated as follows: *Hygienic*, *expectant*, *palliative*, *stimulant*, *antiphlogistic*, *eliminative*, *revulsive*, and *antipyretic*.

Hygienic treatment consists of measures involved in the treatment of cases of disease which are neither medicinal nor remedial. Agreeably to this definition, hygienic treatment embraces diet, temperature, ventilation, climate, exercise, bathing, out-of-door life, and, in short, everything pertaining to mental as well as physical regimen. Hygienic measures play an important part in clinical medicine, and with reference to which a few general rules may here be stated. Alimentation forming an essential part of the sustaining treatment, whenever this is indicated the diet is of great consequence, and the practitioner should not fail to give it due attention. In acute diseases there is rarely a desire for or relish of food, and it is often loathed. Solid food can not be taken, and the diet must, therefore, consist of gruels, animal broths, and milk. Of the several forms of liquid food, milk is the most valuable, because it holds in combination all the different alimentary principles. Were the diet to be limited to a single article, it is much to be preferred on this account. But it is desirable for the articles to be varied, and, therefore, different forms should be given in alternation. Milk, as well as different farinaceous articles, may enter into the composition of gruels, forming what is called, in some sections of this country, porridge. Whey and cream are devoid of the most nutritious principles of milk; buttermilk, however, containing the nutritious principles minus the fat, is a fair substitute. The animal broths, as a rule, do not contain a large amount of nutriment, unless prepared without boiling and with the addition of nitro-muriatic acid, or the solid residue pulverized and added. The so-called "beef peptonoids" of Reed & Carnrick is, perhaps, the most valuable extract of beef ever produced, either for stomach digestion or rectal alimentation. Broths, however, may be made highly nutritious by the addition of farinaceous articles. Ordinary beef-tea has very little nutritive value, while many of the so-called meat-extracts in use are only useful as stimulants, conveying into the system very little material for nutrition.

"The intervals between the administration of food should not be long; but they are often much too short. In general, two hours at least should inter-

vene. The length of the intervals should depend somewhat on the quantity given at a time. This will depend upon the ability of the patient to take it, and the tolerance of it, together with the evidence of its being digested. If food occasions neither vomiting, flatulence, nor diarrhœa, it is fair to assume that it has been digested, or, at least, that it has not proved hurtful. The persistent employment of the same articles of diet, prepared in precisely the same way day after day, is never judicious. The patient acquires a disgust for them which becomes at length intolerable, and for this reason they are not only given with difficulty, but they are not likely to be digested. The articles and modes of preparation should be varied. All the circumstances connected with the administration of food should be arranged, as far as possible, with a view to render it acceptable."

The foregoing rules apply to cases in which sustaining measures are indicated. In other cases of either acute or chronic disease, as a rule, with some exceptions (as diabetes mellitus and the use of certain medicines), the instincts of the patient should govern the dietetic treatment. It is generally safer to follow the patient's inclinations, as regards the quantity of food taken and the articles of diet, than any notional or theoretical ideas. In the opinion of Professor Flint, Sr., more harm results from an attempt to conform the diet to any plan of restriction than will be likely to follow an unrestrained alimentation. The appetite and taste in disease, as well as in health, generally represent the needs of the system, and are more reliable than rules derived from speculation or reasoning. This doctrine has the merit of great simplicity; it divests of difficulty the dietetic treatment in cases of disease.

"The importance of endeavoring to secure an adequate alimentation in acute diseases is to be measured by the fact that many of the grave phenomena which they manifest are attributable to inanition, and, in many instances, patients literally die from starvation. In chronic diseases it is obvious that defective nutrition stands in a causative relation to decreased weight and weakness of all the functions of the body.

"Physicians are expected to regulate the quantity and kind of drink which patients are to take. Thirst is usually a prominent symptom in acute diseases if the perceptions have not become blunted, and in general it expresses a requirement which should not be opposed. The common belief that a craving for fluids should not be gratified is a part of the popular error which regards all the desires in cases of disease as morbid, and therefore not to be considered in the light of indications for treatment. This error has stood in the way of not only relief from suffering, but the favorable course of disease. As a general rule, the quantity of drink in a given time is to be regulated by the desire for it. Experience shows that it is often better for drink to be given in small quantity at a time, after short intervals, than for a large quantity to be taken at once. When the perceptions are much blunted, the need of the system for fluids is not expressed by the sensation of thirst. The patient does not ask for drink, and yet, when roused sufficiently and drink be offered, it is often taken with avidity. As with food, so with drink; under these circumstances the judgment of the physician should take the place of the instincts of the patient. The system requires fluids, and they are to be given systematically and enough to meet the supposed requirements, bearing in mind that it is better to exceed rather than to fall below the quantity required. As regards the kind of drink: when thirst is a prominent symptom, pure cold water is generally the most acceptable. Toast-water has the advantage of being slightly nutritious. Usually, if more agreeable, water may be acidulated with the juice of the lemon or orange, with sugar added to suit the taste. The mineral acids, added for a remedial influence in continued fevers, may be taken in this way without giving to the drink the character of a medicine.

"The temperature and ventilation of the apartments of the sick claim attention on the part of the practitioner. Popular errors in regard to these elements of hygienic treatment prevail largely, notwithstanding the efforts within late years to popularize correct sanitary rules in health and disease. In

private practice especially, if pains be not taken to prevent it, the temperature of the sick-room is apt to be too high, from a common belief that a cold or cool atmosphere is attended with danger in cases of acute disease. The reverse is much nearer the truth. Breathing a cool, or even a cold, atmosphere is refreshing and invigorating. A sufficient warmth of the body can always be maintained by clothing; the latter is apt to be too abundant. Here, as in other matters relating to hygiene, the sensation of comfort, if the mental perceptions be not blunted, is a trustworthy guide. As a rule, the temperature of the room should not exceed 60° F., and, when practicable, should be regulated by the thermometer. In affections which interfere with respiration, breathing a much cooler atmosphere than this may lessen the suffering of the patient and conduce to the welfare in other respects. The popular apprehensions of harm from temporary exposure of the body to a cool, or even cold, atmosphere are groundless. Physicians not infrequently err in sharing these apprehensions. Patients with acute febrile diseases rarely 'take cold.' In fact, in fevers, what may be termed the cold-air bath diminishes the body-heat, and thus, as an antipyretic measure, is useful, although less efficient than the use of cold water for this purpose. In the inflammatory affections of the air-passages, however, breathing constantly a very warm and moist atmosphere has a salutary local effect, and, in some of these affections, is an important measure of treatment.

"Purity of the atmosphere is a most important hygienic condition. Every one has experienced the lassitude and general *malaise* which follow breathing, even for a few hours, the vitiated atmosphere of a crowded, illy ventilated theatre or lecture-hall, and yet the physician often finds the atmosphere of the sick-room so confined and impure as to be equally if not more oppressive. Such an atmosphere can not fail to have an unfavorable influence on patients. Physicians should not consent to treat cases of disease in small bedrooms unless it be a matter of absolute necessity, and then the freest possible ventilation should be enforced. The exclusion of sewer-emanations is of vast importance, and attention to this point should not be omitted. The exclusion of light is often carried too far, as this agency often exerts a vivifying influence. A darkened sick-room, as a rule, has an unfavorable moral and physical effect, but may be admissible for a tranquilizing influence in some cases of cerebral disease and nervous excitement.

"The propriety of a change of climate is to be considered in connection with the treatment of certain chronic affections, more especially of phthisis. Out-door life, or such exercise as is consistent with strength, is not only itself beneficial for convalescents, but greatly assists the action of tonic treatment for this class of patients, and, unless contra-indicated by circumstances peculiar to certain diseases, such as intestinal lesions of typhoid fever, judiciously regulated exercise and the influence of open air greatly promote the appetite, digestion, and expedite restoration to health.

"In addition to the foregoing classes of hygienic measures, those which produce effects through the mind are of no small importance. Occupations which divert the thoughts from morbid sensations, or which prevent introspection and watching the different functions of the body, are often of vastly more importance to the welfare of patients than the administration of drugs. Judicious recreation is a potential measure of treatment in functional affections of the nervous and digestive system. Much often depends upon the cheerful surroundings of patients as regards recovery as well as the preservation of health. It is no disparagement of the prescriptions of the physician to say that they are often of less value than the moral effect of his encouragement, for it is intended by this statement only to express the great importance of *psychical* therapeutics. In the treatment of cases of acute disease the varied details embraced under the name of "good nursing" have an importance which the public and many physicians have hitherto not sufficiently estimated. The most skillful and judicious methods of treatment may prove unavailing from lack of the co-operation of intelligent, instructed, and faithful nurses."

Expectant Treatment.—According to Dr. Flint, this mode of treatment has been erroneously defined as founded on the principle that the restorative power should be allowed entire freedom of action, the practitioner neither assisting nor interfering with its operation. As the term is much used in medical conversation and literature, and not always in the same sense, it is important that its meaning should be more accurately understood. It ought not to be considered to mean that the treatment during the whole course of the disease should be restricted to hygienic measures. The term "expectant" signifies waiting for the indications which call for activity of treatment. Such indications may or may not be present during the course of different diseases. They may be present at some periods and wanting at other periods during the course of disease. They may be present in some and not in other cases of the same disease. In meeting indications, the expectant physician ceases to be merely an observer, and employs measures which may be among the most potential in therapeutics. As an illustration, in the essential fevers the expectant system is followed when the physician waits for a certain amount of increased body-heat, and then resorts to the cold bath or large doses of sulphate of quinine or other drugs to diminish hyperpyrexia. With this understanding of the meaning of the term, expectation does not signify "therapeutic nihilism" or a "do-nothing" treatment. It is a mode of treatment opposite to a routine practice, and that which resorts to perturbatory agents not having reference to definite objects. As thus defined, this mode of therapeutics is applicable to the treatment of a large proportion of the cases of disease, but it is a *symptomatic* rather than a *pathogenetic* method of therapeutics.

"*Palliative treatment* consists simply in the adoption of means which are calculated to soothe and to lessen suffering, and thereby prolong life when the cure of disease is not possible.

"*Stimulant treatment* is founded on a doctrine which regards most forms of disease as associated with or dependent on a lowered state of the vital powers, and which teaches that in such cases the free use of stimulants is the practice most to be relied upon."

Antiphlogistic treatment is the converse of the preceding. It recognizes, in many forms of disease, increased nervous excitement and vascular fullness, which are to be remedied by depressing agencies, such as low diet and other measures of depletion.

Eliminative treatment aims at removing, by the intestinal mucous membrane, by the skin, or by the excretory glands, respectively, certain morbid matters, and thus allowing the restorative power of the system to operate more efficiently. This treatment includes the use of purgatives, diaphoretics, diuretics, emetics, alteratives, and hydropathic measures.

Revulsive treatment acts by producing counter-irritation by means of blisters, setons, issues, and rubefacients, and the treatment is based upon the assumption that if there is a morbid accumulation of blood in one part of the system from congestive inflammation or nervous irritation, it is correspondingly diminished in another.

Antipyretic treatment of recent origin has for its object the reduction of hyperpyrexic degrees of temperature which are considered destructive to life, and includes measures which increase heat loss through the skin, or diminish heat production by controlling the febrile movement. The agencies employed for this purpose are nauseant diaphoretics, bathing with tepid and cold water, the wet pack, the cold bath, and quinine or salicylic acid in large doses. The requisite indications for this treatment are obtained by the use of the clinical thermometer.

It is well known, says Dr. Quain, that, under these several and varied modes of treatment, disease may yield and patients get well. Hence it has been said that, as different means are made use of to obtain a single result, the treatment of disease can never be absolutely scientific. Phthisis is pointed out, for example, as a disease which one person seeks to relieve by cod-liver oil, another by climate, a third by tonics, a fourth by sedatives, a fifth by at

tion to the digestive organs, and a third by counter-irritation. But it need scarcely be said that the disease bearing the name of phthisis is an aggregate of phenomena or morbid conditions, the relief of any one of which may lead to the amelioration of the others. Thus the general health might be improved by climate, and with it all the other symptoms. Cod-liver oil, and with it remedies calculated to improve the digestion, may lead to healthy nutrition, and thus to mitigation of all the symptoms. The like remark applies to the other agencies mentioned, and the principle may be extended to many other diseases. The treatment of disease must not, then, be considered as unscientific because it can not remedy a variety of morbid states by a single agent, but would aim, on still strictly scientific principles, by different agencies, to overcome disease the effects of which are manifested in different forms.

As remedies, of course, hold a prominent place in the treatment of disease, other general considerations are appropriately presented in this connection.

Active treatment in cases of disease may be potential for either good or harm. In other words, there are therapeutic measures which are like a double-edged sword, cutting both ways; hence, if not useful, will be hurtful. This statement applies to blood-letting, powerful cathartics, emetics, mercury, and the so-called heroic treatment by various agencies. Now, it is to be assumed, as a governing principle in clinical medicine, that the first duty to the patient is not to do harm. Whenever, therefore, the physician makes use of a remedy which, if it do not benefit, will be injurious, it should be clear to his mind that the remedy will accomplish the object intended, and that the accomplishment of the object is desirable. "If there be doubt on these points, duty to the patient requires forbearance in the use of the remedy. Resort to a treatment which, if it do not cure, will kill, would be never justifiable. On the contrary, there are remedies which, under certain circumstances, are potential for good, and which, if not beneficial, will do little or no harm. Opium and full doses of quinine are in this category." Before resorting to active treatment in cases of disease, the question is to be considered, "*What will be the consequences if it fail to be of service?*"

Active treatment should always have reference to a distinct purpose subsidiary to the general objects in therapeutics—namely, arrest of disease, cure, palliation, and support. Remedies of potency, resorted to without any aim, if they do neither good nor harm, tend to disturb or obscure the symptomatic phenomena of the disease, and, for this reason, are not advisable. "Knowledge of the clinical history and laws of different diseases has an important bearing on the treatment. What is the intrinsic tendency of the disease as regards recovery or a fatal termination? What is its duration? Are certain symptoms likely to continue or cease spontaneously? These are among the questions to be considered in the interpretation of therapeutic indications. Other things being equal, such as accurate knowledge of the uses and effects of remedies, he is the best therapeutist who knows best the symptomatology of diseases and their natural course, this knowledge having been acquired at the bedside. Indications for active treatment are by no means always proportionate to the severity of disease or the danger attending it. The desire to employ powerful remedies in severe and dangerous cases is natural, and it is also a natural desire to meet in this respect the wishes of patients and their friends; but it is a part of the mental discipline of the physician to restrain those desires, and to follow only clear indications according to his knowledge and experience."

Flint remarks that it is a good rule to employ but a few remedies at a time in treating cases of disease. If a patient take a multiplicity of remedies, either in combination or at different hours during the day, the effects of such can not be well observed. If the treatment appear to be useful, the physician is unable to judge which of the remedies it is desirable to continue, or he is not able to decide which to discontinue should the treatment appear to be harmful. The use of remedies of diverse powers wi

antagonize one another, and render their action inert. The physician should not attempt to meet too many indications at once, and should remember that there is a therapeutic and physiological, as well as chemical, incompatibility of medicinal agents. The physician can obtain but an imperfect experience by treating cases with a multiplicity of remedies. The objects in combining drugs are either to correct, modify, or increase the action of one another—as in the use of diuretics, cathartics, etc.; to obtain the joint action of two or more diverse substances which may lessen some unpleasant physiological effect; to unite certain drugs whose chemical reaction may form a new compound; and, finally, to give medicines consistency and form, as well as to render them attractive in appearance and palatable to the taste. Aside from these objects, simplicity in prescriptions is to be commended. Formulæ embracing numerous ingredients of no essential importance are to be discountenanced as a remnant of medical pedantry. At the present time the country is flooded with medicinal preparations in which different remedies are combined, emanating from apothecaries and manufacturers of drugs; their use and indorsement by medical practitioners, being matter of interest as a branch of trade, is persistently urged. In general, these should be employed by physicians with great reserve and discrimination. "The same hat can not fit every head, or the same shoe do for every foot; neither can the proportion of ingredients in a ready-made, semi-legitimate, pharmaceutical 'catchpenny' nostrum suit every patient. No intelligent physician should prescribe a proprietary remedy, or one covered by a trade-mark; it is better for the profession and for the patient's welfare to avoid the use of all such ready-prepared remedies, whether trade-mark, proprietary, or quack, whether advertised to the profession or to the public, whether the so-called formula is given or not." Preference should, as a rule, be given to officinal preparations recognized in pharmacopœias. And oftentimes it is best, in many respects, for the physician to prepare and dispense his own prescriptions.

"It is perfectly proper to take cognizance of the influence exerted on the minds of patients by the use of remedies. Hence, placebos may be indicated." Patients are apt to think, when sick enough to send for a doctor, that they are sick enough to take medicine, and, unless prescribed for in some form, they are dissatisfied, and will most likely call another physician. "If it be said that sensible persons ought to be satisfied not to take remedies if the unassisted powers of nature are sufficient to effect a cure, and the physician thinks they are not required, the answer is, however intelligent and strong-minded a person may be in health, he is often otherwise when sick. They who have had ample experience in treating patients in all classes of society are aware of the fact that persons of the strongest intellect are childish in disease. What Shakespeare said of imperial Cæsar in Spain is true to nature. Erroneous ideas of disease and medication are often enough held by those who are learned in other departments of knowledge." No better illustration of this fact can be given than to cite the readiness with which some people of so-called culture will espouse and champion that absurd system of medicine known as homœopathy. That has been most aptly described as "*not anything so much as nothing that looks like something*"—a wonder, creating something made of nothing, whose chief use is to amuse the feeble. Of course, no honest and intelligent physician can for a moment countenance that which violates common sense in the adoption of the infinitesimal doses, nor follow any of the other nonsense and follies of Hahnemann; "but he *can follow the fashion of the day*, and can give to every fastidious or squeamish patient the smallest and most pleasant dose that his safety will permit, and can avoid giving any one crude remedies to a disgusting degree." An earnest aim to please every one's taste and ideas of medicine, as far as compatible with his safety and recovery, is a procedure to be commended in every rational medical man. "To prescribe, however, placebos which are absolutely inert, is, to say the least, undignified. It is a deception which, excepting when it enters into scientific observations, co

promises self-respect. Nor is it necessary. There are always minor indications to be filled with remedies which incidentally secure the mental influence it is deemed important to exert." In the treatment of cases of chronic and sometimes of acute diseases, it is often a good plan to withhold all active medication, in order to observe the condition of the patient as uninfluenced by the effects of remedies. This not only enables the physician to determine the actual effects of the treatment employed, but to judge of indications for resuming medication. "In treating cases with reference to symptomatic indications, the remote effects of the treatment are to be considered. Blood-letting, for example, will relieve promptly acute pain in the early stage of pneumonia, although, in view of other circumstances, and with regard to its ulterior effects, it be contra-indicated. A dyspeptic patient may derive an immediate advantage by restrictions in diet; but, if these be carried so far that the system fails to receive adequate alimentary supplies, common sense teaches that the body must deteriorate in nutrition and strength."

The practitioner has to deal with idiosyncrasies, real or fancied, as regards the effects of remedies. There are real idiosyncrasies which are to be heeded. Long familiarity in the use and effects of remedies, and the peculiarities of patients from their general appearance, will sometimes enable a practitioner to tell, as if by intuition, just what drugs will best agree with certain individuals—

"Till old experience doth attain
To something of prophetic strain."

Sometimes the effects of quinine are not tolerated, and require to be modified by the conjoined use of hydrobromic acid, ergot, opium, or capsicum. The iodide of potassium affects some persons unpleasantly, and occasionally produces violent toxical symptoms, which may be lessened or prevented by combination with aromatic spirits of ammonia. The effects of opium may be so unpleasant and severe that patients are reluctant to take it, and so this may be successfully counteracted by the addition of atropine or the bromides of potassium or sodium. Others, again, are ptyalized by the smallest quantity of mercury. It is, therefore, a good rule in all such cases to inquire as to the existence of a special idiosyncrasy with regard to such drugs, and either to withhold their use or antagonize their unpleasant physiological effects by appropriate and judicious measures, or substitute other agencies. Idiosyncrasies are, however, often fancied. "A species of egotism leads many to imagine that they have an unusual susceptibility to drug[s]. The belief in a peculiarity of constitution in this regard, or in an ability t[o] tolerate enormous doses, is a source of satisfaction. Dealing with fanci[ed] idiosyncrasies often calls into requisition the judgment and tact of the pr[ac]titioner. Opiates and alcoholic stimulants hold an important place in thera[-] peutics. Their employment in cases of chronic disease may lead patients t[o] become addicted to their habitual use and attendant evils, which may some[-] times be far worse than death itself. The danger of so great a calamity e[n]forces the importance of great discretion in the employment of these thera[-] peutical agents. The administration of opiates in any mode should not b[e] advised unless the patient remains under medical observation. Time[ly] warning with regard to the danger of the opium-habit should be given whe[n]ever it is called for. If the opium-habit is already formed, the importa[nce] of immediate and complete discontinuance is to be impressed. The mo[st] effectual method of cure is to persuade the patient to at once abandon its u[se]. The plan of leaving it off by degrees is not likely to succeed, as it requires perseverance and moral courage which few are able to maintain." It is bett[er] to encounter, says Flint, the severe distress which attends the sudden int[er]ruption of the habit. The physician can do much by encouragement to e[n]dure the distress until the system is adjusted to the change. A few we[eks] generally suffice, and the suffering diminishes much after a few days. T[he] [di]stress is often so great that the firmness of the physician is apt to give w[ay]. [The] plan, however, in the majority of cases, is perfectly safe. The earlier i[t is re]sorted to, the less the intensity and duration of the suffering, and the gre[at-]

the prospect of success. If the habit has been long continued, the demoralization is such, and the will-power becomes so enfeebled, that the prospect of success is small; but the importance is so great that no effort should be spared for its accomplishment. It is the duty of physicians to point out to patients the pathological effects of the habitual use of alcoholic stimulants beyond physiological limits. Cirrhosis of the liver and other effects are often produced in persons who are not drunkards. A morbid craving for stimulants, which may lead to intemperance, is sometimes incident to affections of the digestive organs and of the nervous system, ceasing when health is restored. As is well known, some persons are afflicted with a periodical craving for alcoholic excitation, as an idiosyncrasy, and some are so constituted that the slightest indulgence creates an irrepressible desire to drink to intoxication. Such persons should never have the authority of medical advice for taking stimulants of this class, unless it be in acute disease. But it should be said, to the credit of the profession, that physicians are rarely responsible for the intemperate habits of their patients. But, however formed, drunkenness, in a clinical point of view, is to be considered as a malady over which the subject has no more control than over the course of some other constitutional diseases. What is true of drunkenness is equally true, if not far more so, of the opium-habit. Patients of either class should be treated by discontinuing the use of these agencies, and by the employment of medicinal and moral means to restore health and fortify the will. For the accomplishment of this purpose, the establishment of well-managed asylums is not only a great philanthropic measure, but an absolute public necessity.

Quoting the views of the author last mentioned, it may now be useful to glance at some of the sources of error in therapeutics incident to the imperfections of our existing knowledge, one of which is a lack of knowledge of the natural history of many diseases. This is a fair inference from past experience. Diseases which were formerly considered as having an indefinite duration, and tending to a fatal termination if active treatment were not employed, have since been shown to be self-limited, with an intrinsic tendency to recovery. It can not be affirmed positively of any case of disease that the favorable termination or the duration is due to therapeutical agencies until the course of the disease has been observed in a certain number of cases in which no active measures of treatment were employed. Some maladies subside spontaneously in a certain proportion of cases. This fact is to be taken into account in judging of the efficacy of the so-called abortive or specific measures of treatment. Changes for the better or for the worse, occurring independently of treatment, are apt to be imputed to the latter. The favorable ending of a disease from self-limitation may be attributed to the remedy or remedies which immediately preceded convalescence.

"A source of error is in reasoning *a priori* either from supposed or established physiological effects of remedies or from pathological doctrines. This is a legitimate method of reasoning; but the correctness of conclusions is to be confirmed by experience. Errors of this class may be distinguished as theoretical. The past affords examples of therapeutic measures based on pathological doctrines now obsolete. Errors originate in fallacious experience. New methods of treating cases of disease are announced and advocated on the ground of remarkable success. They are eagerly adopted by many; but on trial it is found that their claims to success are without foundation. Errors from this source are to be guarded against by reserving conclusions until a sufficient number of observations have been made. Making careful records of cases, and accepting the results of the analytical study of them, constitute a safeguard. Accepting opinions simply because they emanate from those entitled to respect, accounts for the diffusion of errors which may be called errors of authority. This habit is vastly less prevalent now than in the past history of medicine, but it still has a large influence on therapeutics. Authors and teachers, however distinguished, are certainly not infallible, a[nd] should not unduly control individual judgment, or supersede personal

rience. An over-readiness to adopt novelties in practice leads to what may be distinguished as errors of credulity. There are those who are ready to at once accord full faith in new remedies or methods of treatment, and in this country especially, if imported from abroad. Some physicians are never discouraged in adopting novelties, the claims of the latest being always promptly acknowledged. These physicians have an overweening confidence in the resources of therapeutics. They are in strong contrast to those who, either from indolence or obstinacy, become confirmed '*routinists*' in medical practice. The latter class have been called '*monumental*' physicians, representing in their practice, not the progress of medicine, but the past." In common parlance, they are known as "moss-backs," or "old fogies."

"Errors arising from a lack of faith in therapeutical resources may be designated as errors of skepticism. In all these matters a medium course is the safest and most judicious. Leaving out the question as to whether more harm results from too little than too great confidence in active treatment, it is certain that a physician who is hopelessly distrustful of all curative agencies had better choose some other calling than the practice of medicine. The wise practitioner is the servant and not the master of nature; but he is an unprofitable servant who is content to be always an inactive spectator of disease. A just appreciation of the powers of nature will secure against errors of credulity, while that of the resources of therapeutics will prevent those of skepticism." In connection with this subject, Dr. Cathell has very truly said that "physicians are far more imperfect than physic." It is too often the case that evil results have been unjustly charged to classes of medicine and to the art of medicine when plainly due either to the physician's bad judgment or to his ignorance, especially if the medicine be given when not indicated, or in wrong quantities at improper intervals and without proper restriction as to its use being enforced. The fact is, all physicians know of very nearly the same remedies, but skill in curing with them consists in giving the right medicine at the right time and in the right doses. "A proper use of medicines, instead of a wholesale renunciation of them, is a leading characteristic of a good physician. Ability to determine accurately the condition of a patient, and to conceive and to do the right thing for him at the right time, is the essence of skill, and is the chief difference between successful and unsuccessful doctors, and is the great secret why the prescriptions of some medical men are much more valuable than those of some others. Whenever a doctor, who wishes to be considered as in advance of others, or extraordinarily fair in his opinions, is heard to boast that he 'does not believe in drugs,' 'depends on nature,' it may be safely assumed that he is wofully deficient in his knowledge of materia medica, or that he overstates his credulity, or that his usefulness has run to seed." In other words, he is either a knave or professionally a very ignorant man. Is there an honest and intelligent physician on earth willing to allow malarial fevers to take their course without drugs, syphilitic and other poisons develop or progress unattended? who confesses that he can do nothing for pain, for fever, for nervous complaints, for digestive affections, or chest diseases? nothing for the circulation, or delirium, insomnia, headache, epilepsy, hysteria, neuralgia, rheumatism, colic, acidity, peritonitis, constipation, diarrhœa, anæmia, scurvy, and the vast majority of other ailments which afflict the human race? If there is a doctor in the land who has never seen medicines restore health or prolong life, who does not sincerely believe in his power to benefit by drugs most of the hundreds of diseases and modes of decay to which mankind is subjected, he should at once and forever, in justice to his own conscience and in justice to suffering humanity, take down his sign and no longer pretend to practice that profession for which he is neither fitted by nature nor capacity. Modern medicine has no room for therapeutic nihilists ...nky" representatives, whose zeal to become medical philosophers is ...atio to good judgment and rational therapeutics. The physician ...es medicine successfully and satisfactorily must believe in the

utility of the means employed, and his knowledge and experience should be sufficient to enable him to "give a reason for the faith that is in him."

With reference to these points, one of the most popular medical teachers of the day remarks that physicians are often heard to complain that the published results of others, in respect to the utility of a particular plan of treatment, can not be realized in their own experiences; but the secret frequently is, that they entirely overlook the important fact that one physician may summon to his aid all that mysterious mental force in hope, faith, and expectant attention, and another represses it, not consciously to himself, by a lack of personal enthusiasm, and still more by a lack of confidence in his own powers and in the power of his remedies—fatal defects in the character of the physician, which do not escape the keen scrutiny of an anxious patient. To employ the common term of personal magnetism to express this quality on the part of the successful physician would be improper and without meaning. Such an influence is not to be considered a magnetic quality or power, not a mysterious gift possessed by the chosen few, but is that which inspires a supreme, unquestioning, an absolute belief in the efficacy of the means proposed, and is only the reflex of the confidence of the physician, and need not imply a boastful, self-asserting egotism on the part of the physician, nor the blind faith of ignorant credulity on the part of the patient, *but may be based upon the well-founded convictions of the enlightened therapeutist, confident in his resources from long experience or thorough knowledge of their capabilities.*

The art of healing must always depend in part upon empirical observation and in part upon deductive science; but, in both alike, the physician should be the minister and interpreter of nature. In other words, the "end and aim of the practitioner should be, if possible—first, to discover the cause or causes on which the disease depends, and remove or counteract them, if practicable; and, secondly, to endeavor by every available means to restore health to the functions of the body, and, with that object, to guide or assist nature, but never to thwart her operations."

In concluding the subject of "Treatment of Disease," the following aphorisms and recognized therapeutic maxims may be presented as representing the professional creed of "modern" medicine:

1. "That every physician should have an abiding faith in medical science and in the resources of medical art, especially as regards the power, the value, and the necessity of medicinal agents.

2. "That all medicinal agents that have force enough to do good, if rightly given, may do harm if wrongly given.

3. "That, as physicians should never interfere actively in disease without a distinct object, such agents should not be prescribed unless a clear necessity is recognized for their employment.

4. "That this necessity may arise from the patient's physical condition, from the patient's mental condition, or 'from the mental condition of others.'

5. "That in all cases the least disturbing remedies that will meet the indications should be prescribed.

6. "That in every form of disease the innate powers of nature should be recognized as the chief factor in restoring health; the *rôle* of art is that of an auxiliary and assistant.

7. "That, as physicians should act only on scientific reason or well-defined experience, fashions in therapeutics should be followed only when the new mode has the sanction of one's scientific knowledge, or is sustained by unimpeachable testimony.

8. "That physicians should treat the *cause* of disease whenever possible, but watch always and treat when requisite the *condition* of the patient.

9. "That physicians should treat patients rather than diseases, and that '*routine*' treatment, according to the name of the disease, is to be specially avoided as unscientific and as liable to be hurtful as beneficial.

10. "That physicians should use no violence with 'self-limited' diseases

and should trust all diseases to nature where art can not declare an assured benefit by intervening.

11. "That the guiding principle of every practitioner of 'rational' medicine should be to ask himself what is the best plan of treatment known to the world in the management of a given case, and to adopt that treatment independently and irrespective of all schools and systems of medicine."

The Relations in which Medical Men Stand to the Law.

The relations of physicians to the law have been summarized under three heads:

1. "As a plaintiff. There is nothing in the profession peculiar to the physician. A 'visit' *per se* is not a valuable consideration, and therefore not a lawful demand. 'A professional visit at the request of defendant' is recommended as a proper form.

"The defense. He did not cure or benefit defendant is no bar to recovery, as *skill* and *care*, NOT cure or benefit, are the conditions of the implied contract.

2. "As a defendant. The law presumes that a physician agrees to furnish the fair average skill of the craft, NOT *the highest known* to the profession.

3. "As a witness. This may be ordinary or expert. The ordinary witness testifies only in regard to what he saw, heard, or observed in the case, the same as any other witness. *As expert*, the position of the physician is judicial, and *he should be called by the court*, and not by the contestants."

If medical societies would take action favoring the adoption of a law requiring medical experts to be employed by the court, it would not only be greatly to the interest of the medical profession, but the general adoption of such a law would, no doubt, facilitate trials and the course of justice.

The Professional Conduct of Physicians.

In this connection certain points and rules of conduct may be mentioned having reference to the relation between physicians and patients. One point of primary importance relates to the manners and appearance of the medical practitioner. "In no profession or calling are coarseness, vulgarity, untidiness, and repulsive habits more incongruous than in medical practice."

The public is apt to form its opinion from the most superficial points of observation, and often judges a medical man from his personal appearance. "If a physician dresses neatly and well, he is employed more readily, accorded more confidence, while his bill will be expected larger and paid more willingly."

"Cheerfulness of mien is an important element of clinical medicine. It is not merely a politic accomplishment, but a professional duty. Its moral influence upon patients entitles it to rank among the measures of treatment.

Patients are apt to believe that which they wish or fear;
Their minds are often biased as your manner may appear;
But 'hope springs eternal in the human breast,'
And of all tonics it certainly is the best.

"It is a duty to manifest a proper degree of interest and sympathy in cases of disease. This not only wins the confidence and attachment of patients, but an influence is thereby secured which, judiciously managed, may be useful in treatment."

"Flexibility of manner, self-command, quick discernment, address, and ability of the physician to adapt himself to the ever-changing phases of medical practices are qualities in which he should seek to become perfect. The physician should school himself until he can prevent his thoughts and opinions from showing on his countenance. Discipline the features and manners so that the nervous and sick patients can not detect unfavorable reflection about themselves that it is best to conceal. The physician should never exhibit surprise at any possible event growing out of sickness, as he is sup-

posed to foreknow all conceivable things relating to disease, its dangers, and terminations. In accidents, he should observe as to nature and degree; also, in cases of sudden illness, when pressed to know whether the case is dangerous or will be of long duration, he should choose his language deliberately, and give only indefinite answers until it can be seen whether new symptoms will develop, whether the system will react, and whether there will be a response to the remedies employed." The physician should never give his opinion with reference to a case without first ascertaining as to whether his previous directions have been complied with. "The physician should study to acquire an agreeable and professional manner of approaching the sick, and to take leave of them with equal skill. There is an art in entering one's sick-room with a calm, earnest manner that shows an anxiety to learn the patient's condition, making the necessary examination, and then departing with a cheerful, self-satisfied demeanor that inspires confidence on the part of the patient and his friends, and a belief that you can and will do for him all that the science of medicine teaches any one to do. In this way a physician should act toward patients so as to remove all dread of his visits, especially avoiding a solemn, formal, or funereal manner."

"It should be a rule of professional conduct not to communicate information concerning the maladies of patients except to those entitled to receive it, as patients have a right to the privacy of their diseases, although it is but little respected by individuals or the public. "What is the matter with this or that patient?" is often asked in innocence of its impropriety, and does not challenge the physician's rebuke; but the question, being improper, often justifies an evasive answer.

"The physician should be ready to overlook the waywardness, ill-humor, and prejudices of those to whom he is called to minister in disease. He should not be over-sensitive as regards personal dignity, and, as far as possible, he should refrain from exhibitions of irritability of temper. Sickness claims forbearance and charity. Still, there are limits to endurance and encroachments on self-respect. If a patient, whose intellect is unaffected by disease, refuses to follow the treatment which the practitioner decides to pursue, he should at once decline any further responsibility in the case; and if there be other manifestations of want of confidence, the case should be relinquished."

In conclusion, certain rules relating to professional visits may be mentioned.

"The frequency of visits, aside from the wishes of patients and friends, is to be regulated by the importance of observing variations of symptoms or the effects of treatment, and of this, of course, the physician is the best judge. The liability to err in the number of visits is in making too few rather than too many, for the reason that physicians are generally sensitive in regard to an imputation of making more than are required. This sensitiveness, carried to an excess, not infrequently is of damage to the physician, patients inferring lack of interest or attention. Too short intervals between visits are sometimes objectionable, leading to injudicious changes of treatment. In general, it is not advisable to remain constantly with patients, unless for the purpose of carrying out measures of treatment which require continued supervision. Regular visits should not be so brief that full attention can not be given to the case, and the physician should not appear to be hurried. The patient is apt to be left in an uncomfortable frame of mind if there be occasion to think that the case has not been well considered. On the other hand, visits should not be too prolonged. After examining, prescribing, and giving full directions, the sooner the physician takes his departure the better, if there be no special reasons for delay." During a professional visit, the first and chief topics of conversation should have reference to the case. It is a great mistake to act as if the latter were of secondary consideration, the greater part of the time being devoted to extraneous matters. If the conversation digresses to other subjects, shift it back to the patient and his case as soon as possible.

"The physician has a perfect right to relinquish attendance on a case when he deems that his interest or reputation require it; but, when he does so, he should let his withdrawal be fully understood. It is better, however, to plead having *too much other business*, and not to take undesirable cases at all, than to take them and involve himself, and afterward relinquish or neglect them."

If physicians would charge full *night-visit* fees for *all* visits after bedtime, they would be less often compelled to undergo loss of rest and exposure in attending those who could have sent at a more seasonable time. When visiting a patient, he should always let it be known whether he will visit him again, and when; it not only satisfies him, but prevents all uncertainty. When a case has so far convalesced as to make frequent visits unnecessary, and yet mends so slowly or irregularly as to cause the physician to fear an arrest of improvement or relapse, it is better that he should keep sight of him by calling once in a while and letting it be known when he will call again, with an understanding that, if the patient gets worse in the meanwhile, to let him know, and if he is so much better as to render the promised visit unnecessary, to send him word; this plan is, for many reasons, better than quitting such cases abruptly.

Clinical Records.

With reference to this subject, Dr. Austin Flint, Sr., insists that the medical student can not too early begin to take notes of the cases brought under his observation. These early records may have little value for subsequent reference, but they involve an exercise of great use in acquiring the art of observing and in becoming familiar with clinical facts. Daily records of important cases are recommended no less for physicians than for students, and in private as well as hospital practice. The practice of recording cases has many advantages, some of which may here be briefly noticed.

"It improves the powers of observation, and leads to the discovery of personal deficiencies in this regard which may be overcome. The ability to observe correctly is not a natural gift, nor does it accompany as a matter of course the acquisition of knowledge from reading or didactic lectures. It is an art to be acquired.

"It qualifies for describing with clearness and conciseness the symptomatic phenomena in cases of disease. The ability to use language with accuracy and precision in simple description is not an innate faculty, but an acquirement. It secures a more thorough study of cases in consequence of more concentrated and prolonged attention than the cases would be likely to receive were they not recorded, and in this way it has a favorable influence on the diagnosis and treatment.

"By inducing reflection, and leading the practitioner to consult standard works with reference to points of inquiry which arise, it conduces in no small measure to professional improvement.

"Continued for a series of years, it furnishes an accumulation of clinical experience which may be reviewed or referred to with great profit. The analytical study of cases which have been recorded may lead to results which contribute to an enlargement of the boundaries of medical knowledge."

In keeping records, the plan advised by Dr. Flint is a very simple one, and on that account is to be preferred to printed case-books, in which blank spaces may be either too large or too small. Volumes of records advised by the distinguished clinical observer and teacher referred to should be of medium ledger size, with a wide margin on each page for notes or references. Commencing at nearly the middle of a page, in order to have abundant room for headings to be inserted after the case is ended, the history is carried onward to successive blank pages, noting at the bottom of each page the one on which the history is continued, and at the top of the latter the page from which the record has been brought forward. After the volume is filled, the cases should be indexed after the names of the diseases. They may also be

indexed after the names of the patients. If cases prove fatal, the results of autopsical examinations should be embraced in the histories. Dr. Flint bears testimony, from an experience of forty years, to the great value of clinical records for reference in cases which come under observation a second time, or repeatedly, perhaps, after long intervals, and also for reference in certain cases to the progenitors or members of the same family.

"A satisfactory report of a case should embrace all the important points presented, concisely and lucidly, without needless details. In recording cases, the importance of noting negative as well as positive facts is to be borne in mind. The value of notes for reference or analytical study is often much impaired by omissions in this respect. It needs only a few words to note the absence of important symptoms referable to the respiratory, the circulatory, or other of the physiological symptoms. Without these statements the histories are open to the criticism that certain symptoms may have existed which were either overlooked or, from inadvertency, not noted."

The following "*hints on case-taking*," published by Dr. Roosevelt, of New York, in "The Medical Record" (February, 1883), is intended to give an outline of the symptoms and signs to be sought for and recorded in medical cases:

"The importance of accuracy in recording cases is self-evident. The scheme here given may seem long and complicated, but in serious cases the facts sought may be all of importance. It will be seen that many of the questions refer to the possible existence of chronic disease of certain viscera. Information is sought in regard to such disease for various reasons, among which are the following: Prognosis in a given acute case may be gravely influenced by complicating chronic disease; differential diagnosis may be assisted by knowledge of such disease; an acute case may be followed by an outbreak of symptoms due to pre-existing chronic disease, which had heretofore remained in a comparatively quiescent condition, in which case knowledge that symptoms of such disease have previously existed is of interest and value. Moreover, autopsy frequently shows diseased conditions of certain organs which were never suspected during life. It is a matter of importance to know whether symptoms of such disease were ever manifest during life, or whether the conditions never gave any symptoms. It is often as necessary to state that symptoms do not exist as that they do.

"The order in which the facts are recorded is, of course, not that in which they are obtained. It is suggested merely because, if followed, it makes a connected history, with facts of a general nature as a sort of introduction. If the history of the case be covered by one of the heads suggested in the scheme, it seems better so to change the order that such history fall just before the heading 'Present Condition.' Common sense must dictate how far the scheme shall be followed in each case.

"In taking a history, the first points to be ascertained are the symptoms which trouble the patient most. He should, as far as possible, be made to tell his own story. Direct questions should be avoided until the physician is convinced that no more information can be obtained without them. The history should cover every point, but be as short as possible.

"The physician should have no preconceived idea of how the case should run, but simply aim to record facts as they come to notice. Every sense should be trained, so that nothing escapes notice, and nothing is imagined to exist which does not exist. The previous history of a patient should be verified by judicious cross-examination. A history, when first recorded, had better be too long than too short. It may be shortened afterward, though the information contained in it should not be altered unless shown to be false."

GENERAL PLAN FOR THE RECORD.

Name of Patient, Age, Civil Condition, Occupation, Birthplace, Race, Residence.

"These facts should head the history. The importance of recording the age of a patient is obvious. By civil condition is meant whether mar-

single, widow, or widower—facts which may or may not be important. Occupation, because of its bearing upon certain diseases, should be noted. It is customary to note the birthplace, because information may thus be obtained leading to suspicion of diseases, endemic in certain localities, which may influence diagnosis. In this country, where so many races come under observation, information upon this point is interesting, because of the alleged different courses of various diseases in different races. Residence should be noted, because of its importance in infectious diseases, and in general hygienic conditions, favorable or unfavorable to disease."

FAMILY HISTORY.

"Information should be obtained in regard to the existence or non-existence of the following diseases among near relatives (parents, grandparents, uncles, aunts, brothers, sisters, children):

"*Phthisis* should be looked for. In connection with phthisis or tuberculosis, *struma* should be borne in mind.

"*Syphilis.*—Unless the parents themselves can be observed, a history of syphilis in a family can rarely be obtained. When found, it is often of great value. Of course, this disease is of importance among relatives in a direct line with the patient, hardly so among collateral branches.

"*Gout*, *rheumatism*, *cardiac* or *renal* disease, existing among relatives, may be of much interest and value.

"Especially in the case of patients suffering from disease of the *nervous system*, similar disease among relatives should be noted.

"*Intemperance* in many members of a patient's family should be recorded.

"*Tumors* among relatives of patients, themselves suffering from tumor, is important.

"*Hæmophilia* among relatives deserves investigation.

"When any of the above diseases are shown with reasonable certainty to exist, it is sufficient to note the fact. When their existence seems only probable, the reasons for supposing them to exist should be stated.

"The early history of the patient himself should now be recorded."

PREVIOUS HISTORY.

"*Use of Stimulants.*—Note if the patient drinks, how much, and what kind of liquor he uses. Cross-examination on this point is necessary. Before forming a judgment as to the temperance or intemperance of a patient, the number of glasses drank daily should be ascertained. Also inquire whether the patient gets drunk, and, if so, how frequently. Men who are not habitual drunkards rarely drink before breakfast, and the habit of drinking at this time almost necessarily shows that the patient drinks to excess. Information on this point may be valuable. There are patients who are evidently suffering from alcoholism who deny the use of liquor. Such must be judged upon their own merits. This subject is enlarged upon because of mankind's tendency to deceive in regard to the matter. Excessive use of tobacco may be noted.

"*Syphilis* may be a factor in any case, no matter what the social or moral standing of the patient. Here, again, deliberate deception is not uncommon. Sometimes patients, especially women, do not seem to have noticed the primary sore. It will not do merely to ascertain the existence or non-existence of a chancre; the following symptoms should be looked for: If a sore be acknowledged, it should be ascertained how soon it appeared after a suspicious connection. Whether a sore be acknowledged or not, symptoms of constitutional infection may be discovered. Eruptions, falling off of the hair, sore throat, sore eyes, nocturnal headache, or other pains, tenderness of tibiæ, sternum, clavicles, enlarged glands, gummy tumors, staining of the skin, ul-[illegible]—these are symptoms individually of more or less value, a history of [illegible]h may be obtained from patients who deny all primary infection. The

diagnosis of syphilis may be safely made if a number of them be admitted. The nature of the primary sore should be inquired into, and whether it was followed by a suppurating or non-suppurating bubo. In infants the special symptoms of inherited syphilis must be looked for.

"*Rheumatism.*—Attacks of acute inflammatory rheumatism, because of their relation to cardiac disease, and of the predisposition of patients having had one attack to others, must be noted. If a patient suffer from chronic arthritis, whether due apparently to rheumatism or not, it is as well to record the fact. So-called muscular rheumatism may be noted. Chorea should be noted for the same reason as rheumatism.

"*Scarlatina*, being frequently followed by rheumatism, should be inquired into. The rheumatic attack in very young children may show itself only by tenderness of the joints without swelling or redness. The child seems to suffer pain and is restless, but only upon touching one of the affected joints can the cause of these symptoms be appreciated. It is very easy, therefore, to overlook the disease if the patient be too young to speak. Yet a rheumatic attack of this obscure nature may induce serious cardiac lesions.

"*Gout.*—This disease should be differentiated from rheumatism, with which it is frequently confounded by the laity. The train of evils which gouty poisoning is stated by various authorities, with more or less show of reason, to induce, makes an investigation of the subject necessary. It is stated to be an ætiological factor in forms of renal and cardiac disease, skin diseases, dyspepsia, diabetes mellitus, asthma, bronchitis, neuralgia, especially of the fifth pair of nerves and sciatica, renal colic, and various affections of the central nervous system, besides a number of other diseases. Whether these statements are correct or not should be determined, at least so far as certain diseases are concerned, by further study.

"The pains of syphilis or neuralgia may be mistaken by a patient for attacks of rheumatism or gout.

"*Malarial Fevers.*—In this country, where diseases of this type are so common, attacks of intermittent or other true malarial fevers should be noted. Poisoning from these diseases seems sometimes to leave its mark upon the constitution for a long time. It is to be remembered that typhoid and other continued fevers may be spoken of by the patient as 'malarial.' Hectic from any cause may be mistaken for intermittent. In cases where the patient states that he has had 'chills and fever' he must be made to describe the disease.

"Severe attacks of *any acute diseases* should be noted, and any *injury* which the patient may have received should be described.

"*Pulmonary disease*, chronic in its nature, should be looked for. Cough and its character, expectoration and its nature, shortness of breath, fever, night-sweats, progressive loss of flesh and strength, hæmoptysis—any such symptoms are important, even if they have ceased to exist for some time before the patient comes under observation.

"*Cardiac Disease, Renal Disease, Dyspepsia.*—These three classes of diseases are grouped together because some of their symptoms are so similar that it is impossible to separate them for purposes of general investigation. Palpitation of the heart, attacks of dyspnœa, and the effect of exertion upon those conditions; præcordial pain and anxiety, angenoid attacks, or true angina pectoris; dimness of vision, seeing of floating spots (muscæ volitantes); headache, local or general, sense of discomfort in head, mental depression, confusion of mind; lumbar pains; œdema of face or extremities, or any form of dropsy; changes in color or amount of urine (frequency of micturition may be mistaken for increased amount of urine); nausea and vomiting, abdominal pain or discomfort, flatulence, eructations, bitter or sour in taste, and the relation of these symptoms to the kind of food and the time it is taken; variations in the appetite, constipation, or diarrhœa—these are the principal symptoms to be sought for in ordinary cases. Attacks of *jaundice* should be noted.

"The presence of *hæmorrhoids*, or the *passage of blood* at stool, may serve to direct attention to obstructed portal circulation.

"Symptoms of disease of the *nervous system*, epileptiform seizures, paræsthesia, paralysis, neuralgia, and other pains, whether apparently of central origin or not, mental symptoms, hysterical symptoms, etc., are frequently important.

"In men, *sexual habits* should be investigated. In women, the history of the *menstrual life* should be taken. The time of the establishment of the function, irregularity of menstruation, menorrhagia, metrorrhagia, suppression of discharge, painful menstruation, leucorrhœa, pain in the back, headache, should be noted. Pregnancies and their results in miscarriage or labor may be important. There are a certain number of cases in which sexual habits should be looked into.

"The *place of residence* of the patient, its sanitary condition as regards light, ventilation, cleanliness, warmth, drainage, and number of residents, is highly important in many cases. In *infectious disease* every possible source of contagion by fomites or otherwise should be sought.

"After these facts should follow a clear account of the attack for which the patient seeks advice. The exact time when the attack commenced should, if possible, be ascertained; its mode of invasion, the order of development of symptoms, the possible causes (exposure to cold or infection, extraordinary exertion, a spree, anything which may be a factor in the case), should be carefully noted. Every detail which the patient is able to give in regard to his case should be recorded."

PRESENT CONDITION.

"Under this heading it is intended to record the condition of a patient when he first comes under observation. The *general muscular development* of a patient and the quantity of adipose tissue enveloped, and his condition as to strength or weakness, being general notes, form properly the first observations to be recorded. The points next to be noted are the expression of the face, decubitus if the patient be in bed, peculiarities of gait or attitude if he be up. The color of hair, eyes, etc., may or may not be important. It is important to observe whether the face is pale, flushed, or normal in color. If pale, the skin may be translucent or opaque, very white or yellowish, or dirty-white or greenish; the lips and mucous membranes may be pallid, or bluish, or normal, or too red; and any of these conditions may be moderately or extremely marked—facts which should be recorded. If flushed, the redness may be bright or dusky, diffuse or localized, with the rest of the face pale or natural in color. The surface may be cyanosed. The color of the sclera may be white and natural or yellowish, or quite yellow or bluish. It may appear opaque or translucent. The conjunctiva may be injected or not. There may be lachrymation or discharge of muco-pus from the eyes. There may be strabismus—a symptom of little value unless its existence or non-existence before the attack for which the patient seeks relief be ascertained. There may be nystagmus. The condition of the pupils, their size, and reaction, should be noted. They may be unequal or equal; both may react badly or well, or not at all; they may be dilated or contracted; one may react, and the other not. One pupil may be irregular in outline, and this may be due to an old iritis, possibly in its turn due to past syphilitic or rheumatic outbreaks. In testing the pupils, it is necessary to observe all the precautions usually advised. The eyes may be protuberant or sunken. The alæ of the nose may both dilate extremely with inspiration, or one may do so, or their movements may be hardly noticeable, or one or both may have a tendency to fall in with inspiration. The lips may be tremulous, pale, red, bluish, or purplish, dry, moist, cracked, or coated with sordes. The facial muscles may be almost immovable, giving the face a vacant expression, or they may twitch, or they may be contracted, producing every variety of expression. The muscles on one side of the face may be

paralyzed, and on the other not; in muscular twitchings of the face any muscle or group of muscles may be affected. The tongue, its size, color, or coat, if present, must be described. The condition of the pharynx, tonsils, and interior of buccal cavity should be observed. Visible small veins should be noted when they occur in the face, or localized—as on the nose. The condition of the larger veins of the head and neck, as to fullness or emptiness, is important. When possible, the entire body of a patient should be examined. The color of the skin, its temperature (as appreciated by the hand), its moisture, its reaction to irritation (as shown by the redness that follows friction), the condition of the circulation (as shown by the rapidity of the return of normal color after pressure has whitened it), are points to be noted. Scars or ulcers should be described, and their causes sought. Eruptions should be described in detail, and not merely mentioned by name. The condition of the extremities in regard to warmth or coldness, and the condition of the circulation in them; clubbing of the fingers, whether the clubbing seems due to an increase of the size of the finger-end or to wasting of tissue in the part, and consequent curving of the finger-nails, should be recorded. Œdema must be looked for. Enlarged cervical, epitrochlear, inguinal, or other lymphatic glands, must be observed. When a gland is enlarged, it should be stated whether it is hard or soft to the touch, painful, or not.

"The frequency of the *pulse* should be noted and its character described. Some confusion has arisen in descriptions of the pulse, owing to the loose way in which terms are used. Walshe, in his work on 'Diseases of the Heart,' gives the following classification of terms: 'Each individual beat may be: 1. Quick or slow. 2. Short or long. 3. Soft or hard, compressible or incompressible. 4. Loose or tense. 5. Empty or full. 6. Narrow or broad, small or large. 7. Single, double, treble, or multiple. 8. With or without special character, vibrating, jerking, bounding, undulating, wiry, filiform. 9. In a series of beats the movements may be frequent or infrequent. 10. Equal or unequal in force. 11. Rhythmically regular or irregular.' These terms are perfectly easy to comprehend, and, as accuracy is important, it is better to use them in the sense in which they were originally intended. The terms 'quick' and 'slow' must not be confounded with 'frequent' and 'infrequent,' and due weight should be given the terms describing the special character of the pulse. The condition of the superficial arteries must be observed. They may be tortuous; their walls may be thickened; calcareous plates may be discovered in the wall; they may visibly pulsate. Pulsation in a vein will, of course, be noted. Influence of posture on the pulse is sometimes important. The *respiration* should be observed, and its frequency and special character, if peculiar, noted. It may be shallow or deep, almost entirely abdominal or thoracic, labored or quiet. The rhythm may be regular or irregular, or of that peculiar type, the 'Cheyne-Stokes.' When the respiration is labored, it should be noted whether the intercostal spaces and supra-sternal notch, and supra- and infra-clavicular regions, collapse in a marked degree with the inspiratory effort, and also to what degree the accessory muscles of respiration are thrown into play. It is needless to say that the thoracic respiration is the characteristic type with the female after puberty, and abdominal with the male and in children, and that a departure from this rule is abnormal. The respiration may be obstructed by some abnormal condition in the larynx, in which case it may be accompanied by noises produced in this organ. There may be obstruction in the pharynx or nares, or buccal cavity. There may be stertor, due to paralysis from some cause of the velum pendulum palati; there may be dyspnœa, subjective, that is appreciated by the patient, or objective, that is appreciable to the observer. The effect of posture and exertion upon this dyspnœa are important points.

"The *temperature* should in all cases be taken and recorded for a sufficient length of time to exclude fever. The frequency of the observation must vary in different cases. In continued fever of any type, observations should

taken at least twice daily of the temperature, the frequency of the pulse and respiration being recorded at the same time. In severe cases the record should be made as frequently as may seem needful. The thermometer may be placed in the axilla, rectum, vagina, or mouth. The difference in heat between the axilla and the rectum or vagina is generally stated to be about one degree. It varies, however, in different cases. Whenever temperature records are made, the situation in which the thermometer is placed should be noted.

"The condition of the *bowels* and the appearance of the *stools* are important. Notes should also be made of the *appetite*, and any abnormalities of it.

"The *urine* should be examined in every case. Albumen and sugar are the most important substances usually sought, and bile or bile-pigment. The reaction, specific gravity, and presence or absence of abnormal constituents should always be noted. It is better, in every case, as a matter of routine, to examine the urine by Fehling's test for sugar, no matter how low the specific gravity, for low specific gravity does not exclude this substance. In looking for albumen, the nitric-acid test, applied according to the directions of Roberts, seems the best. The test-tube containing the urine is held at an angle of about 45° with the horizon, and a small amount of concentrated pure nitric acid allowed to trickle down the side. Being heavier than urine, it sinks to the bottom, and if albumen is present, even in very small amount, a cloud will form just over the surface of the acid. If this cloud disappears on heating the fluid, it is a precipitate of urates; if not, it is albumen. The quantity of acid used should not exceed one tenth of the bulk of the urine. Heat should always be applied, as a proof that the cloud is albumen and not urates. It is well to boil some of the urine, and, if a cloud forms, to add a little acetic or nitric acid, when, if the cloud dissolves, it is composed of the phosphates; if not, it is albumen. The nitric-acid test, as applied above, is, for clinical purposes, the most delicate yet proposed. A rough estimate of the amount of albumen present may be made by acidulating the urine, boiling, setting aside in a cool place, and after some hours estimating the proportion of the precipitate to the whole amount of fluid in the tube. The amount may be expressed in fractions. In collecting urine for examination, only perfectly clean vessels should be used, and it should be kept in a cool place; otherwise fermentation takes place rapidly. When observations are made upon the specific gravity, a specimen should be taken from the mixed urine passed in twenty-four hours, in order to obtain an average. It would be well, if possible, to estimate the amount of urea present in the urine. But there is no way of accurately ascertaining the amount of urea present, which is safe for any one but a chemist to use. The margin of error in every method yet tried is, in the hands of one unaccustomed to chemical manipulations, very great. In all cases in which albumen is present, and in all cases where, from suspicion of renal disease or other reasons, it seems advisable, a microscopic examination should be made. The frequency of the chemical and microscopic examinations must vary in different cases. Once a week, in cases of albuminuria or glycosuria, seems the minimum. As cases increase in severity, the examination may be made more frequently. Some cases require a daily record of the amount of urine passed.

"When necessary, the *reflexes* of skin and tendons should be examined, and areas of anæsthesia and hyperæsthesia, or other peculiarities of sensation, sought for and described.

"After these facts have been noted in every case, there should follow, as nearly as possible, in his own words, the symptoms of which the patient complains at the time he comes under observation. This is highly important. It gives clearness to the record, and brings into prominence symptoms which annoy the patient most. Every symptom should be described in detail.

"*Physical Examination.*—Although many of the signs to be recorded under former heading are noted in a physical examination in its broader yet it seems well to record, in a separate paragraph, the results of

physical examination of the thorax and abdomen, and of any tumors which may be found. There is little to be said on this subject, except that physical signs should be recorded in detail. Murmurs should be located accurately, their time, areas of transmission, and intensity described. Abnormal signs in the lungs or pleuræ should also be located. The size of the liver and spleen should be ascertained as far as possible. The condition of the abdomen as to distention from gas or fluid, the presence of pain or gurgling on pressure, and the location of such pain or gurgling, must be noted.

"*Further Record of the Case.*—The subsequent history of the case and its treatment must be noted as frequently as may seem advisable. All subsequent physical examinations should be recorded when made. It is better to have too many notes than too few.

"A few more suggestions may be of value. It is important that a more detailed description of certain phenomena of disease be given than is usually the case. If a patient have a convulsive seizure, it should be noted whether he lose consciousness, whether the convulsion is local or general, tonic or clonic, or one form alternating with the other; whether the tongue is bitten; whether there is frothing at the mouth, flushing or pallor of the face, how the respiration and pulse are affected; whether there is a flow of urine soon after the fit, how severe the seizure is, what the condition of the pupils and eyes, the expression of the face. If there is an aura, it should be described. Any circumstance which may seem to have determined the seizure should be recorded.

"*Cases of unconsciousness* call for most careful observation. Such information as may be derived from friends will be recorded. The age should be noted when it can be ascertained. When accurate information can not be obtained, some conclusion in regard to age must be drawn from the patient's appearance. The muscular development and adipose envelope should be observed. It should be noted whether the insensibility is complete, or whether the patient can be roused in any way. The odor of the body and breath, condition of the mouth and tongue, frequency and character of the pulse and respiration, temperature, presence or absence of vomited matter, and character, if present; presence or absence of fæces or urine upon clothing are matters of importance. Œdema must be looked for. The color of the face and body, condition of circulation in extremities. Condition of the walls of the arteries as evidenced by touch. Condition of heart as evidenced by physical examination. Examination of lungs should be made. Condition of abdomen should be noted. If the coma be not so deep as to mask them, signs of paralysis may be found. Wounds or bruises must be described. The condition of the pupils and position of the eyes should be observed. Signs of tenderness in any part of the body are important. The urine should be drawn and examined, and its amount noted."

Method of conducting Post-Mortem Examinations.

The great importance of the subject of morbid anatomy renders necessary some account of the manner of examining dead bodies in order to profit by their inspection. Autopsical examinations are seldom made unless some obscurity in the course of the fatal disease excites the curiosity of the medical attendant, or alarms the fears of surviving friends; and even then, unfortunately for pathological research, it is too commonly the fashion to proceed at once to the presumed seat of the disease, and, having detected a supposed sufficient cause of death, to abandon further dissection as useless. "It may safely be said that, if anatomists in general had contented themselves with such superficial inquiries, the science of morbid anatomy would not exist. The cultivation of this department demands unusual devotion, enthusiasm, and perseverance; private practitioners can do little more than contribute an occasional addition to its stores, which must be mainly enriched by physicians attached to public institutions. Even these, if they have not been taught b

a competent instructor, must grope along in obscurity, seeing without understanding, and describing much erroneously or imperfectly, and be content also to devote many hours of severe and disgusting labor to obtain a very moderate degree of proficiency. Yet at no less cost than this can the science of medicine be improved." The following directions, if strictly complied with, will probably be found to promote economy of time and labor, and increase the profit to be derived from dissections. In conducting an autopsy, with a view either to pathological study or medico-legal investigation, *order* and *method* are of great importance.

Among the assistants present at the dissection, one should be charged with writing down whatever may be dictated by the principal operator, and, in order that the record may be readily referred to and nothing omitted in the examination, a uniform rule of procedure should be adopted and all parts of the body thoroughly inspected. The clothing of the operator should be protected by an apron with sleeves, and his hands either anointed with oil or also protected by rubber gauntlets, which prevent their retaining a cadaveric odor or unpleasant smell.

The date of the examination is first to be noted, with the time that has elapsed since the patient's death, and the state of the weather, as these circumstances may influence the degree of change occurring subsequent to death. If the autopsy is held from twelve to thirty-six hours after death, the *external appearance* of the body, its *size*, *weight*, *conformation*, and *color of the skin*, is to be noted, and, in cases of suspected violence, even abrasions should be minutely described. In recording the appearance of the exterior of the body, its degree of emaciation should be stated, and any local tumidity which may exist, particularly of the abdomen; for, if this contains air extricated after death by putrefaction, less confidence must be placed in the changes of color and consistence of internal organs as evidence of disease. The limbs generally grow stiff (*rigor mortis*) when the body becomes cold, and the joints do not recover their pliancy until putrefaction has commenced. This rigidity is most strongly marked in cold weather and in the bodies of persons who have died of acute inflammatory diseases. Its degree should be noted. All discolorations of the skin should likewise be recorded, whether such as arise from disease, cutaneous eruptions, wounds, bruises, etc., or those which depend upon the blood gravitating to the part on which the body happens to have lain since death. The latter are most usually found upon the back and sides, and sometimes on the neck, head, and genitals, giving the skin a purplish or marbled appearance, to which the term *suggillation* has been applied.

This discoloration is distinguished from ecchymosis by its being confined to the capillary tissue of the skin, while extravasation of blood, from blows received during life, exists in the subcutaneous tissue chiefly. Suggillation is most frequently seen when, from any cause, the blood remains fluid after death, and this happens in malignant febrile diseases, from lightning-stroke, and in extremely hot weather.

The three great cavities—the *head*, the *chest*, and the *abdomen*—should always be examined, whether suspicion of disease exists in them or not. To examine the *head*, an incision should be made through the scalp, across the top of the head from ear to ear; the two flaps thus formed should be reflected, the one over the forehead, the other over the occiput. The nature of the attachment of the occipito-frontalis muscle to the bone beneath is such as to allow very easily the loosening of the scalp. The cranium (calvaria) is now to be removed by means of a small saw.

The section of the cranium with the saw should be made through its outer table, completely around the head—from *before backward*, from below the frontal protuberances to the squamous portion of the temporal bone, and ·n *behind forward*, from the occipital protuberance to the squamous por- of the temporal bone, meeting the line just described. The shape of the thus cut out enables it to be maintained in its proper position when the are readjusted. It is removed by the aid of an elevator, or chisel and

hammer, fracturing the inner table of the skull by strokes so applied as not to pierce the brain.

Great care must be taken that the saw does not wound the soft parts within the skull—an accident which may be prevented by not sawing entirely through the bone at all points and by using a dull-edged chisel as a lever to complete the removal of the skull-cap.

The dura mater is then opened by two parallel incisions—one on each side of the middle sinus, and extending from the crista galli to the posterior incision through the skull—after which the *falx cerebri* may be removed by detaching its anterior connection with the ethmoid bone. The condition of the meningeal veins, the amount of fluid in the cavity of the arachnoid, the flatness or proper contour of the convolutions of the brain, the character of the effusion into the pia mater, the adhesion, if any, of this membrane to the surface of the brain, the existence of tumors or abnormal productions of any kind within the cavity of the cranium—should all be passed in review. The brain is then to be examined by removing successive slices of its substance from above downward, proceeding cautiously as the ventricles are approached, so that the amount of fluid contained in them may be justly estimated. The color, consistence, or any abnormal condition of the cerebral tissue, are at the same time to be observed. At this stage the remainder of the brain may be removed by raising its anterior lobes, with the hand carefully placed under them, cutting the internal carotid arteries and cranial nerves as they enter their respective foramina in the skull, dividing the tentorium where it is attached to the edges of the petrous bone, the ridges which guard the lateral sinuses, and finally the vertebral arteries, and then, introducing a scalpel into the spinal canal, the spinal cord is to be severed as low down as possible. The central portions of the brain, the cerebellum, and the membranes covering both, should then be minutely examined in every part.

To examine the *spinal column*, an incision should be made from the occipital protuberance to the extremity of the os coccygis. The deep muscles of the back should then be loosened from their attachments, so as to expose the laminæ and spinous processes of all the vertebræ. With the chisel and mallet, or saw, we must cut through the arches of the vertebræ on each side, close to their articular processes. After thus opening the spinal canal, the cord is to be exposed by dividing the dura mater through its whole length.

To examine the *neck*, an incision should be made through the skin, extending from above the hyoid bone to the upper part of the sternum. Avoiding penetration of the large veins of the neck, the parts to be examined may be carefully dissected, and, if desirable, removed from the body. The thyroid gland, larynx, and its appendages, tongue, pharynx, œsophagus, blood-vessels, and nerves of the neck, may be thus viewed.

To examine the *chest*, two incisions are desirable: the one from the root of the neck, in front, to the extremity of the ensiform cartilage; the other at right angles to this, across the middle of the thorax. The cartilages of the ribs are to be cut through at the lines of junction with the ribs. The ensiform cartilage, being drawn outward, is to be detached from the soft parts, the knife being held *close to the sternum*. The sterno-clavicular articulation may now be opened, and the sternum, with the costal cartilages, raised from its position—a cautious use of the knife being made to remove the adherent soft parts.

The thoracic viscera are now exposed, and may be drawn out with care and inspected in detail.

The heart is first to be examined. The pericardium is slit open and the quantity, color, and nature of its fluid contents, if any, and the condition of its lining membrane, noted. The origin of the great vessels being observed, these are then divided as far as possible from the heart, this organ being drawn gently forward at the moment, and the character of the blood which escapes noticed. The finger is then passed into the large arteries to feel if the valves are pliant, and water poured into them to see if they fulfill their office. A similar procedure should be instituted in the case of the auricu'

ventricular valves. After opening and inspecting the auricles, their capacity, thickness of the walls, condition of their septum, and fibrinous or other contents, the ventricles are conveniently opened by a longitudinal incision extending from the apex to the outlet of each. This is readily made by introducing one blade of a pair of scissors into the aortic or pulmonary artery, and cutting forward through the anterior surface of the heart and parallel to the ventricular septum. The thickness of the walls is to be carefully measured, exclusive of the columnæ carneæ, and at several points between the base and apex; their power of resisting force is likewise to be noted with the color, pliability, incompleteness, adhesions, or calcareous degeneration of the valves. After removing the heart, the pleura is examined, and its contents, adhesions, and condition noted. The pulmonary tissue is then felt, to learn whether it crepitates and is permeable to air, or any portion of it hardened. In the latter case, it is to be incised and minutely examined so as to learn the nature of the substance occasioning the hardness. The bronchi are next laid open by means of probe-pointed scissors; the state of their mucous membrane and that of the secretion contained in them, their deviation, if any, from the usual diameter, and their communication with cavities, if these exist, are all to be recorded, together with the size, position, contents, and connections of the latter.

The greater number and complexity of the abdominal organs render an examination of them somewhat difficult.

To examine the *abdomen*, make a crucial incision, the one branch extending from the sternum to the pubes, passing to the left of the umbilicus, the other transversely across the middle of the abdomen. Care must be taken, in making these incisions, not to injure the subjacent viscera.

After ascertaining the condition of every part of the peritonæum—its liquid contents, the general development of the alimentary canal, the condition of the mesenteric glands, the relation of tumors, if any, to the adjacent organs *in situ*—the next step is to remove the intestinal canal. In order to prevent the escape of its contents, a double ligature is applied at the commencement of the jejunum and another at the caput coli, and the intestines divided between the two threads at each point, and then, an oblique incision being made along the root of the mesentery, the whole of the small intestine, except the duodenum, is at once removed, thus affording room for subsequent operations and allowing the stomach and colon to be readily taken away. The mesentery is next divided by numerous cuts perpendicular to the bowel, so that the latter, instead of hanging in loops, forms a straight tube. The bowel should be divided longitudinally by the *enterotome* (or large, blunt-pointed scissors, having one blade longer than the other) *along the attachment of the mesentery*, so as not to cut through the glands which are for the most part seated upon the free side of the intestine. The stomach and colon are to be treated in a corresponding manner; the character of the contents of these cavities is to be particularly noticed; the color, thickness, and resistance of their mucous membrane at different points carefully tested; search made for ulcerations, enlargement of the follicles and glands; and every deviation from the natural state of the parts accurately described. The spleen, the biliary organs, with their ducts, the pancreas, the kidneys, ureters and bladder, and, lastly, the internal organs of generation in the female, are all to be examined; the solid organs, by numerous incisions with the scalpel, and the interior of the hollow viscera laid open with probe-pointed scissors or by the enterotome.

When—as is always desirable, if possible—both of the large cavities of the trunk are to be opened, a single incision, extending from the top of the sternum to the symphysis pubis, may be made.

In every case, incisions through the skin should be made, as far as practicable, only in those parts that are usually covered by the clothes of the deceased. It is generally advisable, when the abdomen or thorax has been opened, to fill the cavities with bran or sawdust. After the examination has been completed, the edges of the divided integument should be brought together, and retained in apposition by the common continued suture.

Medico-Legal Examinations.

In cases of suspected *poisoning*, the following practical directions are given by Professor Reese, of the University of Pennsylvania, to be observed by those who have charge of *post-mortem* examinations:

1. Ascertain whether the individual has labored under any previous illness, and how long a time had elapsed between the first suspicious symptoms and his death; also, the time that had elapsed after death before the inspection is made.

2. Note all the circumstances leading to a suspicion of murder or suicide—such as the position and general appearance of the body, and the presence of bottles or papers containing poison about his person, or in the room.

3. Collect any vomited matters, especially those *first* ejected, and preserve them in a clean glass jar, carefully stoppered and labeled. The vessel in which the vomited matters have been contained should be carefully inspected for any *solid* (mineral) matters which may have sunk to the bottom, or adhered to the sides. If no vomited matters be procurable, and vomiting has taken place on the dress, bedclothes, furniture, etc., then portions of these must be carefully preserved for future examination.

4. Before removing the stomach, apply *two* ligatures beyond each extremity, dividing between each pair, so as to prevent the loss of any of the contents.

5. If the stomach be opened for inspection, this should be performed in a perfectly clean dish, and the contents collected carefully in a graduated vessel, so as to properly estimate their quantity. [Note here, also, the presence of blood, mucus, bile, or undigested food.] These contents should be preserved in a perfectly clean glass jar, securely stoppered, covered over with bladder, and sealed. The contents of the *duodenum* should be collected and preserved separately.

6. Carefully inspect the state of the *throat*, *œsophagus*, and *wind-pipe* for the presence of foreign substances, and for marks of inflammation or corrosion.

7. Observe the condition of the *large intestine*—especially the *rectum;* the presence of hardened fæces would indicate that purging had not very recently taken place.

8. Note any morbid changes in the *lungs*, as congestion, inflammation, or effusion; in the *heart*, as contraction, flaccidity, presence of a clot; and the condition of the contained blood.

9. Examine the state of the *brain* and *spinal marrow;* and, in the female, the condition of the uterus, ovaries, and genital organs. [Poisons have sometimes been introduced into the vagina.]

10. Along with the contents of the stomach and duodenum, the viscera that are to be reserved for chemical analysis are the stomach and duodenum (to be kept separate from the others); the liver and gall-bladder, spleen, kidney, rectum, and urinary bladder with its contents. Sometimes, also, a portion of the *blood* may be required for the examination.

11. As the legal authorities will rigorously insist upon proof of the *identity* of the matters alleged to be poisonous, it is of the greatest importance to preserve such matters from all possible contamination by incautious contact with a surface or vessel *which is not absolutely clean.* Avoid the use of colored calico or paper for wrapping up the specimens. When once the suspected articles are deposited in the hands of a medical man, he must preserve them strictly under lock and key, and confide them only to a trusty agent for transportation. Many cases are on record where the chemical evidence failed simply from a want of power clearly to establish the *identity* of the matters analyzed.

Actual testing for poisons in cases of suspected criminality ought to be undertaken only by those whose chemical knowledge and skill are considerable.

General Items on Human Viability.

Human life has been divided, according to different physiological transitions, into the following periods, namely: infancy, childhood, boyhood or girlhood, adolescence, virility, maturity, decline, and old age. Infancy applies to the first two years of life, during which the first complete set of teeth is developed; childhood to the age between two and seven or eight, when the first teeth are shed and a more complete set replaces them; boyhood and girlhood, from seven to fourteen or fifteen, the average time of puberty, which forms a marked transition, closing the first general phase of ascending progress. Here youth, properly defined, begins and lasts until the age of twenty or twenty-one, when the physical development becomes complete: the bones are firmly set in all their parts, the mind is also more or less developed, and the sexes have attained "majority" in social life. Adolescence is applied to the first period of adult life—from twenty-one to twenty-eight; and manhood to the riper period—from twenty-eight to thirty-five or thirty-six. The culminating period of physical and mental force combined is termed virility, and this may vary in different individuals, some waxing feebler soon, while others retain all their vigor from thirty-six to forty-eight. The body then begins to lose its energy, and gradually declines through the descending periods of maturity and old age. The mind may still retain its power, and even acquire more knowledge and experience, but the body will not maintain so vigorous an exercise of thought and nervous action as in former years. The subdivisions of descending life are not so strongly marked, apparently, as those of the ascending phases of existence; but in women's life there is a critical period, called "the change of life," which corresponds inversely to that of puberty. The capability of child-bearing begins with one and ends with the other. The "critical period," however, is not so fixed as that of puberty; with some it occurs at forty or forty-two, while with others it extends exceptionally to fifty, fifty-five, or sixty, and in some rare instances still later, the average being forty-five. This period of sterility is less marked and regular in man than in woman. But whatever be the length of the descending phase of life in different individuals, the ascending periods are nearly uniform in their development and average duration. The female sex is usually more precocious than the male, and women average longer lives than men; but that is probably because they are less exposed to accident and danger in the common course of things, for the extreme cases of old age recorded are more numerous in males than in females. Some authorities believe that, under well-devised rules of conduct and favorable external conditions, the natural period of human life might be extended to one hundred years, instead of the "three-score years and ten" of the Bible; and M. Flourens, a French physiologist of high standing, has published a work in which he treats of "human longevity" as dependent upon human prudence, mainly and easily prolonged with care to the limit of one hundred years. History shows that the *natural* term of life has varied little during some four thousand years, and that the proportion of longevity continues much the same at present as it was in former times. The *average* duration of existence is, however, quite another question, and this varies with the favorable or unfavorable habits of the people with regard to industry, morality, and civilized culture.

It is the opinion of good authorities that during the first few centuries of the Christian era the average duration of life with the most favored classes was thirty years, while in the present century the average of the same classes is fifty years. In the sixteenth century the average term of life in Geneva was twenty-one years. Between 1814 and 1833 it was about forty years, and as large a proportion now live to an age of seventy as lived to forty-three years of age three hundred years ago. In the last fifty years the mean term of life seems to have increased from thirty-three to forty-one years. But the average duration of life in some of the principal countries of Europe, according to statistical calculations, still ranges between twenty-six and thirty-

three years; the highest average occurs in countries where wealth, commerce, and civilization are most generally diffused; the lowest where poverty, ignorance, and despotism prevail. These facts have been carefully observed in our time by "life-insurance" companies as the basis of commercial calculations. In the United States the rate of mortality is now estimated at 1·17 per cent. In England the rate is said to be 2·25 per cent; while in Russia the returns of mortality of the whole empire give the rate of 3·50, and considerably more than this for certain provinces, including the basins of the Volga, the Dnieper, and the Don. The average duration of life is therefore higher in the United States than in England and Russia; but we might probably find as many cases of exceptional longevity in Russia or England as in our own land if statistical returns were made with equal care in all three of these countries. Comparative longevity has not received as much attention as the averages of mortality and the mean duration of existence in civilized states. But numerous authentic records of individual cases may be found in every nation where certain persons have attained ages varying from a hundred to a hundred and fifty, and even more, as was the case of the Hungarian peasant, Peter Czartan, who was born in 1539 and died in 1724, thus attaining the extrordinary age of one hundred and eighty-five. But these cases are always exceptional in comparison with the average duration of life, and therefore, as judicious writers have observed, they are "*no fit exponents of the universal natural capacity for life in man.*" Yet the average which falls below the natural term might certainly be raised by due attention to the laws of nature and the known requirements of healthy individuals. The natural term of life differs to some extent, no doubt, in different persons, though not as the natural stature differs in different families, for all men attain to virility at about thirty-five or forty, however slowly they decline in old age. To this extent we may regard the natural term of human development as normal or constant; but some maintain their vigor many years and then decline most rapidly and die, while others decline slowly and enjoy a long evening of life. This view of the fact might give some plausibility to the theory of continuing for all, by artificial means, that slow decline which nature, unassisted, manifests in some rare instances. But nothing being known of the causes of such exceptional longevity, nothing can be logically predicted of the possible results of any scheme devised by man for lengthening the descending period of human life. The old philosophers, therefore, searched in vain for the "elixir vitæ" by which decrepit age might be rejuvenated. Yet, since it is now known that the decline of life and senile decay are always marked by the deposition of calcareous material, which sooner or later leads to death, modern scientists have urged, not without some show of reason, that this event might be greatly prolonged, if not prevented, by the avoidance of alkaline waters, and the occasional or judicious use of some solvent agent like dilute phosphoric acid, but especially by the employment of *distilled* water as an habitual beverage.

Statistics of Mortality.

The terms "rate of mortality" or "death-rate" are defined as the proportion of persons dying to those surviving under given circumstances; or, more generally, the proportion borne by the persons who die to the whole number of those subjected to the given circumstances. Such statistics may relate to the annual mortality of the population of a country, a district, or a city; or of a body of men similarly circumstanced, as of clergymen, or of lead-miners; or of bodies of men otherwise alike, but subjected to different conditions of climate, etc., as the army or navy of a country in time of peace or of war; or of the population, or any section of the population, at special ages, as of infants in factory towns.

Or we may be concerned with the proportions of deaths to survivors, or to the whole number of individuals during and after exposure to a special cause, or causes of death operating either speedily or during a protracted period. As, for example, the mortality sustained by the population of some city dur-

ing the prevalence of a certain epidemic, or that suffered by a number of persons in passing through an attack of any serious malady.

Estimation of Mortality.—The annual mortality of a population is reckoned, not on the numbers in existence at the beginning of a year, but on the mean population for this period of time. The necessity of this becomes evident when we consider that in most countries the large towns are generally increasing at a very rapid rate, while some agricultural districts and unprosperous places actually decline in population. In cities, therefore, the death-rate, if reckoned on the last census, or even on the number believed or estimated to exist at the beginning of the year, would come out higher than naturally, while in declining localities it would be somewhat too low. The average population is to be obtained by adding the existing numbers at the beginning of the year to those present at the commencement of the succeeding year, and dividing the result equally. Similarly, the annual mortality of bodies of troops is calculated on the mean strength.

Two formulas are in use for specifying death-rates. In the first, the proportion of deaths is taken as a unity; thus the mortality of the United States for 1870 would be stated as 1 in 81. In the second, which is more convenient and is now generally employed, the number of lives at risk is taken as 100, or 1,000; thus the mortality per hundred would come out 1·23 (per cent), or multiplied by 10 would show 12·3 (per thousand). Either formula is convertible into the other by simple division: thus, 1,000 ÷ 81 = 12·3, and 1,000 ÷ 12·3 = 81.

Influence of Density of Population.—While it is true that in communities sufficiently advanced to furnish mortality statistics the death-rate diminishes with the progress of civilization, yet a great antagonistic influence must be acknowledged in the principle of the late Dr. Farr, "that mortality increases with density of population." And since "urbanization" advances so rapidly in most civilized countries, all efforts and devices of sanitary and medical science are scarcely able to do more than neutralize its evil effects. It would seem, however, that the mortality of London has, since the seventeenth century, been gradually and greatly diminished. Thus it is said that for the five years ending 1610 (during which time the plague was absent) the death-rate, owing to the closeness and filthiness of the city, was fearfully high, the average annual mortality reaching 70 per 1,000. But at the beginning of this nineteenth century it had sunk to 29, in 1840–'49 it was 25·3, and in 1870–'78 only 23 per 1,000. The death-rate is also diminishing in the United States, in France, Belgium, the Netherlands, Sweden, and Germany, in all of which countries the population, though increasing, is believed to be advancing in comfort, and a general knowledge and observance of sanitary laws; but in Southern and Eastern Europe, and those parts of the world where comparatively little advance has taken place in these respects, no such diminution can be demonstrated. The mortality of cities in different parts of the world is almost invariably higher than that of the rural districts. This rule, however, does not apply to all countries; the exceptions occur mostly where endemic fevers are prevalent. Thus, while the average death-rates of the principal cities of England are now placed at about 23 per 1,000, in the country districts 17 per 1,000 is fixed upon by the late Registrar-General as a kind of standard to be aimed at by sanitarians. It is at once evident that, whatever may be the case in the open country, cities suffer to a considerable extent in the ratio of their ignorance and neglect of sanitary laws, and the poverty and squalor, or barbarism of their populations. Note, for example, the contrast in the subjoined table between the annual death-rates of Philadelphia and St. Petersburg. Cities having a steadily warm climate, or a climate of extremes of temperature, are more unhealthy than those which enjoy a temperate one. By this consideration, combined with that of superior civilization, may be explained the favorable position which some cities have ttained as compared with others which are less favored in these respects.

The following table exhibits the death-rates per 1,000 experienced in 1878 a number of cities in various parts of the world:

DEATH-RATES OF THE PRINCIPAL CITIES OF THE WORLD.

Madras	48·8	Brussels	28·0
St. Petersburg	47·1	New York	24·8
Alexandria	45·4	Dresden	24·7
Buda Pesth	40·3	Paris	24·6
Munich	34·6	Amsterdam	24·4
Naples	33·1	Geneva	23·6
Montreal	30·9	London	23·5
Berlin	29·9	Edinburgh	22·1
Rome	29·8	Brooklyn	20·1
Vienna	29·6	Philadelphia	18·0
Liverpool	29·4	General average	30·1

In this connection the influence of the seasons upon the death-rate of cities should be noted in comparison with that of country districts. The intense cold of winter and the excessive or prolonged heat of summer always tell fearfully upon that portion of the population representing the extremes of life. The following were the death-rates of the *general* population during the four seasons in England and Wales during ten years, ending in 1877:

DEATH-RATES PER 1,000.	Winter.	Spring.	Summer.	Autumn.	Year.
In chief cities	25·8	22·5	23·1	24·2	23·7
In rural districts	21·7	19·3	17·2	18·5	19·0

The reader will observe from these statistics that while the highest general death-rate occurred during the winter, yet the greatest difference between the mortality of cities and country districts occurred during *summer* and *autumn*—the death-rates in cities largely predominating. It should be remembered, however, that upon a general population *winter* is the deadly season, and that cold is more fatal than heat, thoracic than abdominal diseases.

Influence of Age and Sex.—The influence of age and sex on the mortality in England and Wales has been carefully observed, and is here shown in tabular form. The mortality is, per 1,000, at twelve groups of ages in males and females, during the forty-one years ending in 1878:

Mortality per 1,000.	All ages.	0	5	10	15	20	25	35	45	55	65	75	85
Males	23·3	71	8	4	6	8	9	13	18	32	67	147	311
Females	21·2	62	8	4	7	8	9	12	15	28	59	134	287

The superior viability of females is here well-marked, except during childhood and the years of early married life and much child-bearing.

Influence of Birth-Rate.—An appreciation of national and local death-rates depends considerably upon the varying number of births. This ranges in the Continental states of Europe from about 40 per 1,000 in Germany and Austria, and even more in Russia and Hungary, down to 25 in France, and in Britain from 48 to 50; in some coal and iron districts down to 22 in the county of Sutherland. It has been maintained by some authorities that a high birth-rate was a direct cause of a high death-rate, owing to the great mortality among infants. This seems to be an error; the two often concur, but the former is not the cause of the latter, unless where the infants perish in enormous proportion. The usual result of a large, and especially of an increasing birth-rate, is to augment in the community the proportion of children beyond infancy, and of young persons, who ordinarily suffer a very low death-rate as compared with old or even middle-aged persons. The favorable rates prevailing among these young persons overpowering the unfavorable ones of the infants, and of the comparatively small number of old people, the apparent death-rate is actually diminished, instead of being increased, as has been supposed. And this indicates the true reason why the death-rate

of France (as shown in a subjoined table) is higher than that of England, whereas the expectation of life in the two countries is about the same at most ages, the birth-rate of France being exceedingly low. For these reasons is established the principle, "*The lower the average age of the population, the lower the death-rate.*"

It is also with reference to the principle just enunciated that a considerable amount of emigration or immigration affects the death-rate in proportion to the average age of the migrants. Thus the mortality of most great and growing cities would stand worse than it does were it not for the large numbers of young and healthy persons from the country who settle in them. Watering-places and residential towns appear somewhat healthier than they really are, by reason of the number of young domestic servants who form a large portion of their population. But it is in our newly organized States and Territories that the effect of migration on the death-rate can best be studied. The unusually low death-rate of the Northwestern and Pacific States, as shown in one of the following tables, is the result of two kinds of causes, one set of which we may call real, the other factitious or apparent. The former are the cool or equitable climate, and the orderly and prosperous condition of the population; the latter are the constant stream of mostly youthful immigrants and the very high birth-rate. The same factors, no doubt, explain the very low mortality of the British colonies, such as New Zealand, Tasmania, and South Australia, the death-rates of which ranged from one and a quarter to one and a half per cent during ten years ending 1875.

Influence of Station and Occupation.—This subject has been carefully handled by the late Dr. Farr, in England. According to this eminent vital statistician, the influence of trades and professions on mortality is very great. Briefly, it may be said that, of all those that can be isolated, clergymen, lawyers, farmers, and grocers seem to stand best in this respect. Booksellers, paper-makers, wheelwrights, and carpenters also suffer but a small mortality. School-masters and teachers go on well up to fifty-five. Solicitors, domestic servants, watchmakers, shoemakers, and blacksmiths range not far from the average rates; so do bakers (though such is not the current opinion), and the whole tribe of weavers. The workers in iron, as a rule, experience but a low mortality in early life, but a high one as they grow older; the same may be said of millers, and, somewhat strangely (and, no doubt, for very different reasons), of Roman Catholic priests. Tailors begin very badly and end fairly. Medical men, alas! perish frequently in early life, and only attain a respectable position after fifty-five. Chemists, too, and veterinary surgeons come out badly. The figures for miners, naturally enough, are not much different from those for iron-workers, though a little worse. Tobacconists, as might be expected, suffer very heavily until middle life. Printers, book-binders, clerks, commercial travelers, glass-manufacturers, dock-laborers, porters, railway employés, butchers, fishmongers, coachmen, draymen, grooms—all suffer a very high mortality. But the very worst positions are occupied by the dealers in alcohol and in lead (the painters), and by the potters.

These facts and the following tables are of considerable interest, not only in a general and medical sense, but in relation to questions of life-insurance—questions concerning which physicians are so often consulted, and of which, on account of their increasing interest, no medical man can now-a-days afford to be ignorant.

Miscellaneous Statistics.

From recent statistics in the State of Massachusetts, the average duration of life in various businesses and professions has been compiled, and presented on the following page. What is true of this State will probably hold good with reference to other sections of this country. These statistics do not differ ery materially from those of England. The vocations which afford the ortest duration of life are such as involve sedentary habits or exposure to emical poisons and mechanical injuries.

Longevity in the Occupations.

	Years of life.		Years of life.
Men unemployed	68	Masons	48
Judges	65	Traders	46
Farmers	64	Tailors	44
Bank officers	64	Jewelers	44
Coopers	58	Manufacturers	43
Public officers	57	Bakers	43
Clergymen	56	Painters	43
Shipwrights	55	Shoemakers	43
Hatters	54	Mechanics	43
Lawyers	54	Editors	40
Rope-makers	54	Musicians	39
Blacksmiths	51	Printers	38
Merchants	51	Machinists	36
Calico-printers	51	Teachers	34
Physicians	51	Clerks	34
Butchers	50	Operators	32
Carpenters	49	Average longevity	48

Carlisle Tables of Mortality.

According to the Carlisle table of mortality, based upon very extensive observation, and largely used as an authority in life-insurance calculations in America and Europe, of 10,000 children born—

3,540 die in 10 years.	5,603 die in 50 years.	9,848 die in 90 years.
3,910 " " 20 "	6,357 " " 60 "	9,991 " " 100 "
4,358 " " 30 "	7,599 " " 70 "	9,999 " " 104 "
4,915 " " 40 "	9,047 " " 80 "	10,000 " " 106 "

Leaving only one of the 10,000 living at the age of 104 years, and none surviving after 106 years.

DEATH-RATES OF EUROPE.

Since the organization of health-departments, and the increased attention paid to sanitary science within the last twenty years among the different nations of Europe, their death-rates have been reduced as follows: Those of England and Wales, from 35·4 per thousand in 1860 to 20·5 in 1880. Denmark, from 31·2 in 1860 to 20·4 in 1880. Sweden, from 31·2 in 1860 to 18·1 in 1880. Austria, from 39·6 in 1860 to 29·6 in 1880. Prussia, from 38·6 in 1860 to 25·5 in 1880. Switzerland, from 31·6 in 1870 to 29·9 in 1880. Italy, from 37·2 in 1870 to 30·5 in 1880. The German Empire, from 39·8 in 1870 to 26·1 in 1880. The following table indicates the annual mortality of the principal states of Europe. Among these large civilized countries the registration, extending through a series of years (i. e., from 1846 to 1878), is said to have been strictly carried out, and should, therefore, afford a pretty fair representation of the viability of the population of these nations. An examination of these statistics shows the average death-rate of Europe to have been more than double that of our own country in 1870, and about a third greater than that of 1880.

Hungary	36·1	France	22·5
Russia	35·7	Belgium	22·6
Austria	31·1	Scotland	22·1
Spain	29·7	England and Wales	21·8
Italy	29·5	Denmark	19·2
German Empire	27·2	Sweden	18·9
Netherlands	24·4	Norway	17·0
Switzerland	23·5	Average death-rate	[illegible]

MISCELLANEOUS STATISTICS.

Death-Rates of the United States.

The death-rate in the United States varies much from the European, from the highest, in the State of Arkansas, where the annual mortality is one death to every forty-nine inhabitants, a trifle over two per cent of the population, to the lowest, in the State of Oregon, where the death-rate is less than the half of one per cent, or one to every two hundred inhabitants. Taking various sections of our country, the death-rate in 1870 was as follows:

Gulf States	15·8	Western States	12·3
New England States	14·7	Middle States	11·3
Southern States	14·2	Pacific States	8·6
Atlantic States	12·5	Northwestern States	8·3
Mississippi Valley States	12·5	Average death-rate	12·3

According to the United States Census of 1880, the death-rate of the whole United States is 15·1 per thousand, and, from corrected reports of mortality, Dr. Billings now places the annual average death-rate for the whole country at 18·2 per thousand of the living population. It is thought that the reason the mortality of 1880 is found higher than 1870 is owing to efforts made to secure more complete returns of deaths than obtained in previous enumerations. But the mortality of this country is still much lower than that of the principal nations of Europe, which is considered due to the comparative absence of over-crowding, and to a more general and equable distribution of the means of supporting life, including especially the abundant food-supply, of good quality and for all classes of people.

During the year 1880, the total number of deaths from all causes was 756,893. The whole number of deaths of males was 391,960, and of females 364,933. Excess of mortality among males, 27,027. In 733,840 cases of death the causes were known; but in 23,053 cases the causes were reported as unknown. Of the known causes of death reported, 107,904 were from diseases of the respiratory system, 83,670 from diseases of the nervous system, 84,094 from diseases of the digestive system, while 35,932 were set down as resulting from accidents and injuries.

The author regrets that the unabridged volume on vital statistics, which completes the Tenth United States Census, was not published in time for reference in the preparation of this work. But, for the purpose of showing the *comparative* fatality of diseases and other causal conditions, the following table of mortality, derived from the Ninth Census, will prove of equal interest. The *classification* of diseases corresponds to the nomenclature drawn up by a joint committee appointed by the Royal College of Physicians of London in 1869. But, as this nomenclature enumerates over eleven hundred diseases, of course only the more important can here be mentioned. In this classification "general diseases"—that is, affections which appear to involve a great number of diverse organs, or the "whole frame, rather than any special part of it"—are first presented. These *general diseases* are grouped into two sections, A and B. The first are chiefly acute, the second chiefly chronic, disorders.

"Section A comprehends those disorders which appear to involve a morbid condition of the blood, and which present for the most part, but not all of them, the following characters: They run a definite course, are attended by fever, and frequently by eruptions on the skin; are more or less readily communicable from person to person, and possess the singular and important property of generally protecting those who suffer them from a second attack. They are apt to occur epidemically." They have been designated as zymotic diseases.

"Section B comprises, for the most part, disorders which are apt to invade different parts of the same body simultaneously or in succession."

These are also here designated as *constitutional diseases*. They often manifest a tendency to transmission by inheritance.

The second division of the nosological list comprises the so-called "local diseases," and these are grouped in accordance with the organs, or set of organs, deranged—that is, those diseases which are clearly connected with morbid changes of each particular part of the body, as of the liver, the intestines, the kidneys, the ovaries, the brain, etc., are grouped together. And these affections are again collected into larger groups, such as diseases of the digestive organs, of the urinary organs, of the nervous system, etc. The third division comprises all those affections or conditions not necessarily associated with *general* or *local* diseases. In this work they have been arranged under the head of "miscellaneous conditions." This division includes accidents and injuries, all unknown causes of death being placed at the end of the table.

THE PROPORTION OF DEATHS IN THE UNITED STATES FROM EACH CAUSE, AND CLASS OF CAUSES, TO DEATHS FROM ALL CAUSES AND TO POPULATION—1870.

CAUSES OF DEATH.	Deaths from all causes.	Deaths from each cause in 100,000 deaths from all causes.	Deaths from all causes to one death from each cause.	Deaths from each cause in 100,000 living persons.	Living persons to one death from each cause.
GRAND TOTAL	492,263	....	....	1,276·7	78
I. GENERAL DISEASES.					
Zymotic Diseases, A.					
Total	94,832	19,264	5	245·9	407
1. Small-pox	4,507	916	109	11·7	8,555
2. Measles	9,237	1,876	53	23·9	4,174
3. Scarlet fever	20,320	4,128	24	52·7	1,898
4. Typhus fever	1,770	360	278	4·6	21,784
5. Cerebro-spinal fever	651	132	756	1·7	59,229
6. Enteric fever	22,187	4,507	22	57·5	1,738
7. Yellow fever	177	36	2,781	0·5	217,844
8. Intermittent fever	7,142	1,451	69	18·5	5,399
9. Remittent fever	4,281	870	115	11·1	9,007
10. Typho-malarial fever	260	53	1,893	0·7	148,301
11. Cholera	256	52	1,923	0·7	150,619
12. Diphtheria	6,303	1,280	78	16·3	6,117
13. Whooping-cough	9,008	1,830	55	23·4	4,280
14. Influenza	204	41	2,413	0·5	189,012
15. Erysipelas	3,162	642	156	8·2	12,194
16. Puerperal fever	1,828	371	269	4·7	21,093
17. Pyæmia	258	52	1,908	0·7	149,451
18. Other diseases of this group.	3,281	667	150	8·5	11,752
Constitutional Diseases, B.					
Total	93,852	19,067	5	243·4	411
1. Rheumatism	2,912	592	169	7·5	13,241
2. Gout	43	9	11,448	0·1	896,706
3. Syphilis	590	120	836	1·5	65,353
4. Cancer of uterus	510	104	965	1·3	75,605
5. Cancer of breast	630	128	781	1·6	61,204
6. Cancers, other	5,084	1,033	97	13·2	7,584
7. Non-malignant tumors	891	181	552	2·3	43,275
8. Scrofula	3,418	694	144	8·9	11,281
9. Consumption	69,896	14,199	7	181·3	552
10. Diabetes	837	170	588	2·2	46,067
11. Scurvy	69	14	7,134	0·2	558,817
12. Anæmia	265	54	1,858	0·7	145,503
13. Dropsy	7,856	1,596	63	20·4	4,908
14. Other diseases of this group.	851	173	578	2·2	45,309

THE PROPORTION OF DEATHS IN THE UNITED STATES FROM EACH CAUSE, AND CLASS OF CAUSES, TO DEATHS FROM ALL CAUSES AND TO POPULATION—1870. (*Continued.*)

CAUSES OF DEATH.	Deaths from all causes.	Deaths from each cause in 100,000 deaths from all causes.	Deaths from all causes to one death from each cause.	Deaths from each cause in 100,000 living persons.	Living persons to one death from each cause.
II. LOCAL DISEASES.					
Diseases of the Nervous System.					
Total	60,455	12,281	8	156·8	638
1. Encephalitis	13,701	2,783	36	35·5	2,814
2. Meningitis	3,334	677	148	8·6	11,565
3. Apoplexy	5,226	1,062	94	13·6	7,378
4. Sunstroke	397	81	1,240	1·0	97,124
5. Hydrocephalus	4,041	821	122	10·5	9,542
6. Paralysis	7,501	1,524	66	19·4	5,140
7. Tetanus	1,626	330	303	4·2	23,714
8. Hydrophobia	63	13	7,814	0·2	612,038
9. Epilepsy	1,414	287	348	3·7	27,269
10. Convulsions	12,751	2,590	39	33·1	3,024
11. Chorea	76	15	6,477	0·2	507,347
12. Disorders of the intellect	731	149	673	1·9	52,747
13. Other diseases of this group	9,594	1,949	51	24·9	4,019
Diseases of the Circulatory System.					
Total	17,034	3,460	29	44·2	2,264
1. Pericarditis	266	54	1,851	0·7	144,956
2. Valvular disease of heart	881	179	559	2·3	43,767
3. Hypertrophy of heart	757	154	650	2·0	50,936
4. Cyanosis	314	64	1,568	0·8	122,797
5. Aneurism	1,022	207	482	2·6	37,728
6. Other diseases of this group	13,794	2,802	36	35·8	2,795
Diseases of the Respiratory System.					
Total	63,971	12,995	8	165·9	603
1. Croup	10,692	2,172	46	27·7	3,606
2. Laryngitis	295	60	1,669	0·7	130,706
3. Bronchitis	4,049	822	122	10·5	9,523
4. Asthma	1,264	258	389	3·3	30,505
5. Pneumonia	40,012	8,128	12	103·8	964
6. Pleurisy	1,084	220	454	2·8	35,570
7. Hydrothorax	2,689	546	183	7·0	14,339
8. Other diseases of this group	3,886	789	127	10·1	9,922
Diseases of the Digestive System.					
Total	73,999	15,033	7	191·9	521
1. Aphthæ	536	109	918	1·4	71,937
2. Cancrum oris	165	34	2,983	0·4	233,687
3. Teething	3,247	660	152	8·4	11,875
4. Tonsilitis	244	50	2,017	0·6	158,096
5. Gastritis	1,900	386	259	4·9	20,294
6. Dyspepsia	841	172	585	2·2	45,848
7. Other diseases of the stomach	960	195	513	2·5	40,165
8. Enteritis	9,046	1,838	54	23·5	4,262
9. Dysentery	7,912	1,605	62	20·5	4,873
10. Obstructions of the intestines	263	53	1,872	0·7	146,610
11. Hernia	638	130	772	1·7	60,436
12. Diarrhœa	14,195	2,884	35	36·8	2,716
13. Cholera infantum	20,255	4,115	24	52·5	1,904

THE PROPORTION OF DEATHS IN THE UNITED STATES FROM EACH CAUSE, AND CLASS OF CAUSES, TO DEATHS FROM ALL CAUSES AND TO POPULATION—1870. (*Continued.*)

CAUSES OF DEATH.	Deaths from all causes.	Deaths from each cause in 100,000 deaths from all causes.	Deaths from all causes to one death from each cause.	Deaths from each cause in 100,000 living persons.	Living persons to one death from each cause.
14. Colic	1,046	212	47	2·7	36,863
15. Constipation	153	32	3,217	0·4	252,015
16. Fistula	44	9	11,188	0·1	876,327
17. Other diseases of the bowels.	2,550	518	193	6·6	15,121
18. Hepatitis	1,534	313	321	4·0	25,136
19. Cirrhosis of liver	294	60	1,674	0·8	131,151
20. Jaundice	1,311	266	375	3·4	29,411
21. Biliary calculi	36	7	13,674	0·1	1,071,066
22. Other diseases of liver	2,328	473	211	6·0	16,563
23. Peritonitis	957	194	514	2·5	40,291
24. Ascites	1,378	278	357	3·6	27,981
25. Other diseases of this group.	2,166	440	227	5·6	17,802
Diseases of the Urinary System and Male Organs of Generation.					
Total	4,744	964	104	12·3	8,128
1. Bright's disease	1,722	350	286	4·5	23,392
2. Nephritis	517	105	952	1·3	74,581
3. Other kidney diseases	1,724	350	281	4·5	22,366
4. Cystitis	311	63	1,583	0·8	123,982
5. Calculus	73	15	6,743	0·2	528,197
6. Other diseases of this group.	397	81	1,240	1·0	97,124
Diseases of the Female Organs of Generation.					
Total	1,318	268	373	3·4	29,255
1. Ovarian tumors	169	34	2,913	0·4	228,156
2. Diseases of the uterus	1,029	209	478	2·7	37,472
3. Other diseases of this group.	120	25	4,102	0·3	321,320
Affections connected with Pregnancy.					
Total	4,810	977	102	12·5	8,016
1. Abortion	188	38	2,618	0·5	205,098
2. Childbirth	4,406	895	112	11·4	8,751
3. Puerperal convulsions	216	44	2,279	0·6	178,511
Diseases of the Organs of Locomotion.					
Total	2,187	444	225	5·7	17,631
1. Diseases of the spine	1,663	338	296	4·3	23,186
2. Diseases of the bones	132	27	3,729	0·4	292,109
3. Diseases of the hip-joint	188	38	2,618	0·5	205,098
4. Diseases of other joints	204	41	2,413	0·5	189,012
Diseases of the Integumentary System.					
Total	2,778	564	177	7·2	13,880
1. Addison's disease	12	2	41,022	0·0	3,213,198
2. Abscess	665	135	740	1·7	57,983
3. Carbuncle	168	34	2,930	0·5	229,514
4. Skin diseases	1,933	393	255	5·0	19,[illegible]

THE PROPORTION OF DEATHS IN THE UNITED STATES FROM EACH CAUSE, AND CLASS OF CAUSES, TO DEATHS FROM ALL CAUSES AND TO POPULATION—1870. (*Continued.*)

CAUSES OF DEATH.	Deaths from all causes.	Deaths from each cause in 100,000 deaths from all causes.	Deaths from all causes to one death from each cause.	Deaths from each cause in 100,000 living persons.	Living persons to one death from each cause.
III. MISCELLANEOUS CONDITIONS.					
1. Still-born	9,060	1,841	54	23·5	4,256
2. Old age	7,986	1,621	62	20·7	4,828
3. Debility	11,447	2,326	43	29·7	3,368
4. Alcoholism	1,410	287	349	3·6	27,346
5. Lead-poisoning	31	6	15,879	0·1	1,243,818
6. Poisons, not specified	910	185	541	2·4	42,372
7. Parasites—worms	1,069	217	460	2·8	36,070
8. Malformations	364	74	1,352	0·9	105,930
Accidents and Injuries.					
Total	22,740	4,619	22	59·0	1,696
1. Burns and scalds	3,391	689	145	8·8	11,371
2. Lightning-stroke	202	42	2,437	0·5	190,883
3. Explosions	290	59	1,697	0·8	132,960
4. Drowning	4,075	828	121	10·6	9,462
5. Suffocation	1,257	255	392	3·3	30,675
6. Exposure to cold	36	7	13,674	0·1	1,071,066
7. Neglect and exposure	344	70	1,431	0·9	112,088
8. Falls	2,074	421	237	5·4	18,591
9. Falling bodies	712	145	691	1·8	54,155
10. Fractures	665	135	740	1·7	57,988
11. Gunshot wounds	971	197	507	2·5	39,710
12. Other wounds	1,070	217	460	2·8	36,036
13. Railroad accidents	1,582	321	311	4·1	24,378
14. Mining accidents	365	74	1,349	0·9	105,639
15. Injuries by machinery	420	85	1,173	1·1	91,806
16. Other injuries	1,853	377	266	4·8	20,809
17. Homicide	2,057	418	239	5·3	18,475
18. Suicide by gunshot	251	51	1,961	0·7	153,619
19. Suicide by cutting throat	133	27	3,701	0·3	289,913
20. Suicide by drowning	119	24	4,137	0·3	324,020
21. Suicide by hanging	370	75	1,330	1·0	104,212
22. Suicide by poison	203	41	2,425	0·5	189,943
23. Suicide, not specified	269	55	1,830	0·7	143,340
24. Execution	31	6	15,879	0·1	1,243,818
Unknown causes	17,266	3,507	29	44·8	3,233

PRINCIPLES OF LIFE-INSURANCE.

Life-insurance is the guaranteeing of money contingently on human life. The value of premiums on life-insurance policies depends upon the liability of death or life in any given year of the person whose life is insured. The chances of life or death, "the risk," is determined from a *table of mortality* which shows, for each year of life from birth to the highest age attainable, how many persons out of a given number alive at the beginning of any year die by the end of it. There are two tables which are largely used in this country by companies and for State supervisory purposes. One is known as the "English Actuaries'" or "Combined Experience," and the other as the "American Experience." Both of these tables are here inserted for convenient reference. The former, as presented on page 203, is the law of mortality, deduced by the British actuaries from observations on insured lives, first published in 1843 and amply confirmed by later statistics.

British Actuaries' Table,

Deduced from Observations on Insured Lives and the Combined Experience of Seventeen English Companies.

Age.	Living.	Dying.	Chances out of 1,000 of dying in the year.	Natural premium to insure $1,000 for one year.	Expectation—years.	Age.	Living.	Dying.	Chances out of 1,000 of dying in the year.	Natural premium to insure $1,000 for one year.	Expectation—years.
10	100,000	676	6·76	$6 50	48·36	55	63,469	1,375	21·66	20 83	16·86
11	99,324	674	6·79	6 53	47·68	56	62,094	1,436	23·13	22 24	16·22
12	98,650	672	6·81	6 55	47·01	57	60,658	1,497	24·68	23 73	15·59
13	97,978	671	6·85	6 59	46·33	58	59,161	1,561	26·39	25 37	14·97
14	97,307	671	6·90	6 63	45·64	59	57,600	1,627	28·25	27 16	14·37
15	96,636	671	6·94	6 68	44·96	60	55,973	1,698	30·34	29 17	13·77
16	95,965	672	7·00	6 73	44·27	61	54,275	1,770	32·61	31 36	13·18
17	95,293	673	7·06	6 79	43·58	62	52,505	1,844	35·12	33 77	12·61
18	94,620	675	7·13	6 86	42·88	63	50,661	1,917	37·84	36 38	12·05
19	93,945	677	7·21	6 93	42·19	64	48,744	1,990	40·83	39 26	11·51
20	93,268	680	7·29	7 01	41·49	65	46,754	2,061	44·08	42 39	10·97
21	92,588	683	7·38	7 09	40·79	66	44,693	2,128	47·61	45 78	10·46
22	91,905	686	7·46	7 18	40·09	67	42,565	2,191	51·47	49 79	9·96
23	91,219	690	7·56	7 27	39·39	68	40,374	2,246	55·63	53 49	9·47
24	90,529	694	7·67	7 37	38·68	69	38,128	2,291	60·09	57 78	9·00
25	89,835	698	7·77	7 47	37·98	70	35,837	2,327	64·93	62 44	8·54
26	89,137	703	7·89	7 58	37·27	71	33,510	2,351	70·16	67 46	8·10
27	88,434	708	8·01	7 70	36·56	72	31,159	2,362	75·80	72 89	7·67
28	87,726	714	8·14	7 83	35·86	73	28,797	2,358	81·88	78 73	7·26
29	87,012	720	8·28	7 96	35·15	74	26,439	2,339	88·47	85 07	6·86
30	86,292	727	8·42	8 10	34·43	75	24,100	2,303	95·56	91 89	6·48
31	85,565	734	8·58	8 25	33·72	76	21,797	2,249	103·18	99 21	6·11
32	84,831	742	8·75	8 41	33·01	77	19,548	2,179	111·47	107 18	5·76
33	84,089	750	8·92	8 58	32·30	78	17,369	2,092	120·44	115 81	5·42
34	83,339	758	9·10	8 75	31·58	79	15,277	1,987	130·06	125 06	5·09
35	82,581	767	9·29	8 93	30·87	80	13,290	1,866	140·41	135 01	4·78
36	81,814	776	9·48	9 12	30·15	81	11,424	1,730	151·44	145 61	4·48
37	81,038	785	9·69	9 31	29·44	82	9,694	1,582	163·19	156 92	4·18
38	80,253	795	9·91	9 53	28·72	83	8,112	1,427	175·91	169 15	3·90
39	79,458	805	10·13	9 74	28·00	84	6,685	1,268	189·68	182 38	3·63
40	78,653	815	10·36	9 96	27·28	85	5,417	1,111	205·10	197 21	3·36
41	77,838	826	10·61	10 20	26·56	86	4,306	958	222·48	213 92	3·10
42	77,012	839	10·89	10 48	25·84	87	3,348	811	242·23	232 92	2·84
43	76,173	857	11·25	10 82	25·12	88	2,537	673	265·27	255 07	2·59
44	75,316	881	11·70	11 25	24·40	89	1,864	545	292·38	281 14	2·35
45	74,435	909	12·21	11 74	23·69	90	1,319	427	323·73	311 28	2·11
46	73,526	944	12·84	12 35	22·97	91	892	322	360·99	347 10	1·89
47	72,582	981	13·52	13 00	22·27	92	570	231	405·26	389 68	1·67
48	71,601	1,021	14·26	13 71	21·56	93	339	155	457·23	439 64	1·47
49	70,580	1,063	15·06	14 48	20·87	94	184	95	516·30	496 45	1·28
50	69,517	1,108	15·94	15 33	20·18	95	89	52	584·27	561 80	1·12
51	68,409	1,156	16·90	16 25	19·50	96	37	24	648·65	623 70	0·99
52	67,253	1,207	17·95	17 26	18·82	97	13	9	692·31	665 68	0·89
53	66,046	1,261	19·09	18 36	18·16	98	4	3	750·00	721 15	0·75
54	64,785	1,316	20·31	19 53	17·50	99	1	1	1,000·00	961 54	0·50

The above table is very valuable in showing the chances of death each year out of 1,000, and the consequent *natural* premiums payable at the beginning of each year of age to insure $1,000, payable at the end of the year, provided death should occur within this period of time.

The statistics on page 204 show the basis of mortality adopted by the life-insurance companies of New York State. Of 100,000 persons who have reached the age of ten years, deaths will occur as shown in the table. What will occur in any particular case can not be known, but in the aggregate these ratios hold true. In this table the chances of death are stated, but the con sequent natural and office premiums are left for commercial calculation.

AMERICAN MORTALITY TABLE.

Completed age.	Number surviving at each age.	Deaths in each year.	Expectation of life, in years.	Completed age.	Number surviving at each age.	Deaths in each year.	Expectation of life, in years.
10	100,000	749	48·7	53	66,797	1,091	18·8
11	99,251	746	48·1	54	65,706	1,143	18·1
12	98,505	743	47·4	55	64,563	1,199	17·4
13	97,762	740	46·8	56	63,364	1,260	16·7
14	97,022	737	46·2	57	62,104	1,325	16·1
15	96,285	735	45·5	58	60,779	1,394	15·4
16	95,550	732	44·9	59	59,385	1,468	14·7
17	94,818	729	44·2	60	57,917	1,546	14·1
18	94,089	727	43·5	61	56,371	1,628	13·5
19	93,362	725	42·9	62	54,743	1,713	12·9
20	92,637	723	42·2	63	53,030	1,800	12·3
21	91,914	722	41·5	64	51,230	1,889	11·7
22	91,192	721	40·9	65	49,341	1,980	11·1
23	90,471	720	40·2	66	47,361	2,070	10·5
24	89,751	719	39·5	67	45,291	2,158	10·0
25	89,032	718	38·8	68	43,133	2,243	9·5
26	88,314	718	38·1	69	40,890	2,321	9·0
27	87,596	718	37·4	70	38,569	2,391	8·5
28	86,878	718	36·7	71	36,178	2,448	8·0
29	86,160	719	36·0	72	33,730	2,487	7·6
30	85,441	720	35·3	73	31,243	2,505	7·1
31	84,721	721	34·6	74	28,738	2,501	6·7
32	84,000	723	33·9	75	26,237	2,476	6·3
33	83,277	726	33·2	76	23,761	2,431	5·9
34	82,551	729	32·5	77	21,330	2,369	5·5
35	81,822	732	31·8	78	18,961	2,291	5·1
36	81,090	737	31·1	79	16,670	2,196	4·8
37	80,353	742	30·4	80	14,474	2,091	4·4
38	79,611	749	29·6	81	12,383	1,964	4·1
39	78,862	756	28·9	82	10,419	1,816	3·7
40	78,106	765	28·2	83	8,603	1,648	3·4
41	77,341	774	27·5	84	6,955	1,470	3·1
42	76,567	785	26·7	85	5,485	1,292	2·8
43	75,782	797	26·0	86	4,193	1,114	2·5
44	74,985	812	25·3	87	3,079	933	2·2
45	74,173	828	24·5	88	2,146	744	1·9
46	73,345	848	23·8	89	1,402	555	1·7
47	72,497	870	23·1	90	847	385	1·4
48	71,627	896	22·4	91	462	246	1·2
49	70,731	927	21·6	92	216	137	1·0
50	69,804	962	20·9	93	79	58	0·8
51	68,842	1,001	20·2	94	21	18	0·6
52	67,841	1,044	19·5	95	3	3	0·5

Expectation of Life.

Long and careful observations have shown that, though the life of any given individual is proverbially uncertain, yet that, if a large number of persons in ordinary circumstances at a given age be taken, there is a law, fixed and uniform, determining within very narrow limits the average number of years of life remaining to them. For example, if we take 10,000 persons at the age of 22 years, the sum of their ages at death will amount to about 629,000 years; showing that on an average each person now 22 years old will live very nearly 41 years longer. This mean after-lifetime is called *expectation* of life at the insured age, that is, the number of years which one at that age may *probably expect* to live, though many will die sooner, and even 72 out of 10,000 during the first year.

The "expectation of life," or *mean after-lifetime*, remaining to persons of a given age may be of interest to the general reader, but is of little or no practical value in insurance business proper.

Chances of Death.

The real use of a mortality table in an insurance-office is to find the average chance of death or life in any year of persons of a given age. This is obtained or expressed by dividing the number who die in a given year by the number living at the beginning of that year. The chances of death in after years is similarly obtained, by continuing to divide the number who die in each succeeding year by the number who were living at the outset of that year. The sum of the quotients thus obtained will show the total chances of death of a given number of persons of the same age in a given period of years. In the British Actuaries' table, it is seen that the number dying each year divided by the number living at the beginning of the year gives the chances out of 1,000 of dying in that year. And since a fundamental principle of equity of a mutual life-insurance company is that payments shall be proportional to risks, this column or quotient also represents the value of the risk or consequent natural premiums payable at the beginning of each year of age to insure $1,000, payable at the end of the year, provided death should occur within it. But since the natural premiums referred to are supposed to be payable at the beginning of the year, and the death-claims are in theory to be settled at the end of the year, the value of the risk or chance of dying out of a thousand is discounted a year, and, for the sake of safety, at the low interest of 4 per cent. It is fair to state, in this connection, that the premiums noted in the table are *net premiums*, which are always to be increased by a sum sufficient to provide for contingencies, working expenses, and other necessities of the business. Usually about 33⅓ per cent of the net premium is to be added to the net premium in order to form the full or *office* premium. It is of the utmost importance that every life-insurance company should be headed by some thoroughly scientific person, and the success and permanence of the business depends as largely upon the rarer qualities of medical and mathematical ability as on the more common quality of commercial skill.

HUMAN WEIGHTS AND STATURES.

The average height and weight of human beings, at various periods from infancy to old age, is here shown for males and females:

MALES.			FEMALES.		
Age.	Feet.	Pounds.	Age.	Feet.	Pounds.
0	1·64	7·06	0	1·62	6·42
2	2·60	25·01	2	2·56	23·53
4	3·04	31·38	4	3·00	28·67
6	3·44	38·80	6	3·38	35·29
9	4·00	49·95	9	3·92	47·10
11	4·36	59·77	11	4·26	56·57
13	4·72	75·81	13	4·60	72·65
15	5·07	96·40	15	4·92	89·04
17	5·36	116·56	17	5·10	104·34
18	5·44	127·59	18	5·13	112·55
20	5·49	132·46	20	5·16	115·30
30	5·52	140·38	30	5·18	119·82
40	5·52	140·42	40	5·18	121·81
50	5·49	139·96	50	5·04	123·86
60	5·38	136·07	60	4·97	119·76
70	5·32	131·27	70	4·97	113·60
80	5·29	127·54	80	4·94	108·80
90	5·29	127·54	90	4·94	108·81
Mean weight....		103·66	Mean weight		93·73

Children lose weight during the first three days after birth. At t' of a week it is sensibly increased. After twelve months they trip

birth-weight; then they require six years to double and thirteen years to quadruple their weight at one year of age. In a child the head is equal to one fifth part, and in a full-grown man to one eighth part, of the weight of the individual. The human skeleton weighs from 9 to 16 pounds, and the blood from 27 to 28 pounds. A calcined or "cremated" human body leaves a residuum of only 8 ounces. All besides is restored to the "gaseous elements."

Normal Human Weights and Measurements.

Adult male, in good health, average, 66 inches in stature.

Adult male, in good health, 66 inches high, as a rule, should weigh 140 pounds.

For every inch above or below this height, add or subtract about five pounds. Individuals may present a wide range of variation from this, but, as a rule, twenty per cent is almost the maximum variation within the limits of health (Brinton).

Minimum chest, measured over nipples, one half the stature, minus one sixty-first of the stature, is equal to circumference of chest.

Medium chest, one half of the stature plus one fifteenth of the stature.

Maximum chest, two thirds of the stature is equal to circumference of chest (Brent).

The circumference of chest increases exactly one inch for every ten pounds increase of weight.

The difference of circumference of chest, measured over the nipples, arms pendant, when fully expanded and at close of expiration, varies from 1½ to 4 inches.

Vital capacity (number of cubic inches of air which can be expired after a full inspiration) of a man 5 feet 6 inches is 214 cubic inches. For every inch of stature from five to six feet, eight additional cubic inches of air (at 60° F.) are given out by a forced expiration after a full inspiration. When the man exceeds the average weight (at each height) by 7 per cent, the vital capacity decreases 1 cubic inch per pound for the next 35 pounds above this weight (Hutchinson).

The maximum of *height* is usually reached at twenty-five—the rate of progress being about 10 inches from eleven to eighteen, and 2 inches only from that age to maturity.

The average weight of the *brain* in the adult male is	49½ oz. avoir.	
That of the female,	44 " "	(Gray.)
The brain of an idiot seldom weighs more than	23 " "	
The *liver* weighs from	50 to 60 " "	

It measures in its transverse diameter from 10 to 12 inches, from 6 to 7 in its antero-posterior, and is about 3 inches thick at the back part of the right lobe, which is the thickest part.

The *spleen* is usually about 5 inches in length, 3 to 4 in breadth, 1 to 1½ inches in thickness, and weighs about 7 ounces avoir.

Each *kidney* is about 4 inches in length, 2 in breadth, 1 in thickness, and weighs, in the adult male, from 4½ to 6 ounces avoir.; in the adult female, from 4 to 5½ ounces avoir.

The *heart* in the adult measures about 5 inches in length, 3½ in breadth, 2½ in thickness. It weighs, in the male, from 10 to 12 ounces avoir.; in the female, from 8 to 10 ounces avoir.

The quantity of *blood* in the human body is about one fifth of the weight. As 7 pounds of blood pass through the heart in a minute, the whole of the blood (28 pounds) in a man of average weight (140 pounds) is forced through that organ in four minutes.

The above table will be found very useful, as affording standard estimates for comparison in cases of autopsy, examination for pensions, life-insurance, and for other purposes.

In this connection the author desires to call attention to a recent report

of W. D. Whiting, *Actuary* for the "United States Life Insurance Company," with reference to its experience with overweights and underweights.

An examination into the 1,496 instances of 15 per cent excess or deficiency in *weight* as compared to *height*, out of the 33,000 persons insured in this company, shows the following result:

	Lives.	Exposure.	Expected deaths.	Actual deaths.	Ratio of actual to expected.	Average duration of insurance (years).
Overweights, 15 per cent and over	1·110	6·826	95·61	103	107·6	6·15
Underweights, 15 per cent and under	386	2·440	26·05	42	161·2	6·22
Totals......	1·496	9·266	121·66	145	119·1	6·18

"Attention is here called to the ratios of *actual* to *expected* mortality. In both classes it will be seen that the actual is greater than the expected mortality, to an extent that makes it *marked;* and in the class of underweights very *decidedly* so. Both of these classes, then, have been *non-paying* to the company.

"Among the overweights, the most common and fruitful causes of death are diseases of brain, heart, and liver, amounting in all to nearly 44 per cent of the whole number of deaths in this class. Among the underweights, on the other hand, *we are struck with the excessive preponderance of consumption alone over all other causes*—59½ *per cent* of the deaths in this class arising in consequence of this one disease."

Eruption of the Teeth.

DECIDUOUS TEETH.

(These are twenty in number, and the lower generally precede the upper by two or three months.)

Central incisors...	5 to 8	months.
Lateral incisors...	7 to 10	"
First molars......	12 to 16	"
Canines..........	15 to 20	"
Second molars....	20 to 36	"

PERMANENT TEETH.

First molars	5 to 6	years.
Central incisors.......	6 to 8	"
Lateral incisors.......	7 to 9	"
First bicuspids	9 to 10	"
Second bicuspids......	10 to 11	"
Canines..............	11 to 12	"
Second molars........	12 to 14	"
Third molars	17 to 21	"

Eruptive Fevers.

Names.	Incubation.	Day of Rash.	Character of Rash.	Rash fades.	Duration.
Measles. *Rubeola.*	10 to 14 days.	4th day of fever, after 72 hours' illness.	Small red-like dots, resembling flea-bites, first appearing on temples and forehead, forming blotches with semilunar borders.	On 7th day of fever.	6 to 10 days.
Scarlet fever. *Scarlatina.*	1 to 6 days, occas'nally 21 days.	2d day of fever, after 24 hours' illness.	Bright scarlet, rapidly diffused, first on chest and upper extremities.	On 5th day of fever.	8 to 9 days.
Typhus fever. *Ship fever.*	1 to 12 days.	4th to 7th day.	Mulberry-colored maculæ general and abundant over abdomen, extending to extremities.	On 14th day of fever.	14 to 21 days.
Typhoid fever. *Enteric fever.*	10 to 14 days, or suddenly.	7th to 14th day.	Rose-colored papules elevated, few in number, limited to trunk, fresh spots persisting to occur during career.	On 3d or 4th week.	22 to 30 days.

Names.	Incubation.	Day of Rash.	Character of Rash.	Rash fades.	Duration.
Small-pox. *Variola.*	10 to 14 days.	3d day of fever, after 48 hours' illness.	Small, round, red, hard pimples, forming vesicles (*umbilicated*), then pustules, first appearing on face and wrists.	9th day scabs form and about 14th day fall off.	14 to 21 days.
Chicken-pox. *Varicella.*	4 days.	2d day of fever, after 24 hours' illness.	Small rose vesicles which do not become pustular.	Slight scab of short duration.	6 to 7 days.
Erysipelas fever.	3 to 7 days.	2d or 3d.	Diffused redness, either of a dusky or yellowish hue, with swelling.	On 7th to 14th day.	7 to 15 days.
Roseola. *Rose rash.*	6 to 10 days.	After 12 or 36 hours' illness.	Rose-colored spots not elevated, occurring irregularly at different points.	From 24 to 48 hours.	3 to 5 days.

Period of Isolation—of persons with infectious diseases: Diphtheria, measles, scarlet fever, small-pox, 40 days; chicken-pox and mumps, 25 days. These periods count from the inception of the disease, including the period of incubation. Before pronouncing the isolation over, the patient should be bathed.

To Ascertain the Duration of Pregnancy.

The duration of pregnancy in the human female varies. In the great majority of cases it lasts from 265 to 280 days; on an average, 271 days. Since the day of actual conception—that is, the day when the sperm has entered the ovum—is never actually known, and the day of fruitful intercourse only rarely so, we have for determining the time of delivery only the occurrence of the last menstruation. If from that day we count *three months backward, then add seven days*, there will, as a rule, be an error of only a few days. Exceptionally there may be in this way of calculation an error of several weeks.

To calculate from the time the mother perceived the first fœtal movements is much less accurate. Most frequently this takes place toward the twentieth week. It is estimated in primiparæ to occur, on an average, at the 137th, in pluriparæ at the 130th day, and therefore twenty to twenty-two weeks would have to be reckoned for that time. But the first fœtal movements are sometimes perceived before the eighteenth and in other cases after the twentieth week, so that this mode of reckoning is chiefly of value as a check.

Table for Calculating the Period of Utero-Gestation.

Nine Calendar Months.			Ten Lunar Months.	
From	To	Days.	To	Days.
January 1........	September 30.....	273	October 7........	280
February 1.......	October 31.......	273	November 7......	280
March 1..........	November 30.....	275	December 5......	280
April 1..........	December 31......	275	January 5........	280
May 1...........	January 31.......	276	February 4.......	280
June 1...........	February 28......	273	March 7..........	280
July 1...........	March 31.........	274	April 6...........	280
August 1........	April 30..........	273	May 7............	280
September 1.....	May 31...........	273	June 7...........	280
October 1........	June 30..........	273	July 7............	280
November 1......	July 31...........	273	August 7.........	280
December 1......	August 31........	274	September 6......	280

The above obstetric "Ready Reckoner" consists of two columns—one of calendar, the other of lunar months—and may be read as follows: A patient has ceased to menstruate on the 1st day of July; her confinement may be expected at soonest about the 31st of March (*the end of nine calendar months*), or at latest on the 6th of April (*the end of ten lunar months*). Another has ceased to menstruate on the 20th of January; her confinement may be expected on the 30th of September, plus twenty days (*the end of nine calendar months*), at soonest, or on the 7th of October, plus twenty days (*the end of ten lunar months*), at latest.

Signs of Pregnancy.

1. Suppression of the menses.

2. Nausea, vomiting, and digestive disturbances up to the fifth month, then disappearing to appear again for the first fortnight of the ninth month.

3. Enlargement of the abdomen; at three or three and a half months the hypogastric region becomes pouting, and a small protuberance perceptible growing regularly and more voluminous during the remaining term of pregnancy.

4. The fundus uteri, at the end of the third month, is on a level with the superior strait; at the end of the fourth month the uterine tumor can be clearly perceived through the abdominal walls, the fundus being midway between the pubis and umbilicus; end of fifth month, one finger's breadth below the umbilicus; at the end of sixth month, same distance above it; in the seventh month, four fingers above it; in the eighth month, five or six fingers above it; at the beginning of the ninth month, reaches the epigastric regions, gaining the borders of the false ribs on the right side, but in the last fortnight of the last month sinks a little lower.

5. Tumefaction of the breasts, accompanied with a sensation of prickling and tenderness, sets in about the second month, and at the fourth month is much augmented, at which time the nipple becomes prominent, with discoloration of the areola; the latter increases, and the breasts present a spotted appearance.

6. Glandiform tubercles form in the breasts about the fifth month, and are fully developed about the eighth, when flow of milk sets in.

7. Uterus has descended and is less movable in the first two months, the neck inclining toward the left.

8. The umbilical ring is depressed, its bottom drawn downward and backward, the circumference the seat of a distressing, dragging sensation in the first two months; less so in the fourth and fifth months; less hollow than before conception in the fifth and sixth months; the depression is wholly obliterated and on a level with the skin of the abdomen in the seventh month; the navel pouts out in the last two months, and there are streaks and stains on the abdomen, a brown line extending from pubis to umbilicus.

9. Varicose and œdematous condition of the vulva and lower extremities from the seventh month, and increasing until term.

10. Quickening or fœtal movements, sounds of the fœtal heart and abdominal souffle, and fœtal irregularities can be detected about the fifth month.

11. Ballottement can be detected in the sixth month, but more readily in the seventh, and obscurely during the eighth month.

12. Difficult respiration in the latter part of the eighth and first part of the ninth months, but less oppressed during the last fortnight.

13. Difficulty in walking during the last month.

14. Frequent desire to urinate, pains in loins, and colic during last fortnight of the ninth month.

15. The orifice of the os is round in the primiparæ but more patulous in the multiparæ during the first two months; the periphery is at this time softened, but more so during the third and fourth months; the extremity of the finger can be inserted in the os of the multiparæ, while that of the pri

miparæ is rounded and closed; the mucous membrane covering the lips becomes softened and œdematous, also the intra-vaginal portion of the neck.

Table of Fees.

The importance of a fee-table to the practitioner, especially in a legal point of view, when it may be necessary to appeal to a standard of charges, is apparent. In the following classified table will be found the fees required in most of the cases that come under the notice of the physician. These are placed in two columns, one to represent city and the other country charges—the former being taken from the "Fee-Bill of the Philadelphia College of Physicians," and the latter from the "New Table of Fees of the Medical Society of New Jersey." Those in *italics* are from the "Schedule of Prices of Detroit, Michigan," no specifications having been made for the same in the Philadelphia or New Jersey schedules. These fees are placed in the second column of this table.

All of these charges are presumed to be equitable, as they do not differ materially from the established fees of other cities and localities in the United States. In localities where there are no fee-tables adopted, they will furnish an approximation, not an absolute standard, of charges.

It is not to be understood that the omission of any operation or other surgical or medical service from the following fee-bill is a denial of the right to charge for such operation or service a fee proportionate to its nature, extent, and importance.

Accounts should be presented at least semi-annually, or as much oftener as may be deemed proper.

Office Practice.	Philadelphia.	Med. Soc. New Jersey.
For advice at office in a case in which no further advice is required	$10	$3 to $5
This is not intended to apply to those cases in which the physician is considered the regular medical attendant of the individual or of his family.		
For first advice given at office	5	1 to 2
For such advice when minute physical exploration is required	15	3 to 10
For subsequent advice at office to the same individual for the same malady	2	1 to 2
For written opinion or advice to a patient	20	2 to 20
For an opinion involving a question of law	25	5 to 20
For a certificate of the state of health of a patient	10	1 to 2
For a similar certificate in all other cases	25	1 to 2
Vaccination	5	1 to 3
Adjusting truss		5 to 10
Gonorrhœa, in advance	25	5 to 20
Syphilis, in advance	50	10 to 50
Life-insurance examination		2 to 4
General Practice.		
For a single visit, in a case in which no further visit is required, when the physician is not the regular medical attendant	10	3 to 5
For the first visit when the physician is in regular attendance	5	1 to 2
For each subsequent visit	2	1 to 2
Every necessary visit on the same day, whatever may be their number, to be charged at the same rate.		
When at the first visit minute physical exploration is required to arrive at a correct diagnosis	10	3 to 10
When the physician is detained, for each hour	5	50 c. to $1
Prescription for another member of family		1 to 2
For a visit at a time appointed by the patient or his friends, during the daytime	5	1 to 2
For a visit at night, after ordinary bedtime	5	2 to 4

	Philadelphia.	Med. Soc. New Jersey.
General Practice, (Continued.)		
For a visit after night in stormy or inclement weather	$10	$2 to $4
For a first visit as consulting physician	8	3 to 10
For each subsequent visit as consulting physician in the same case	3	2 to 4
For each visit of the attending physician in a consultation.	3	2 to 3
For a visit as consulting physician during the night	15	4 to 8
Remaining all night (not obstetrical)		10 to 20
Rising at night and prescribing		2 to 5
Examination of insane person		5 to 10
Surgical visits		3 to 5
In all visits to distant patients, to be added in addition to the ordinary fee for each mile over two, without regard to the mode of conveyance	2	50 cts.
An extra charge to be made for traveling at night, or on account of the badness of the roads, or the inclemency of the weather.		
Obstetrical Practice.		
For an ordinary case of midwifery	30	10 to 30
For a difficult case of midwifery	50	15 to 30
For every hour the physician is detained beyond twelve an additional fee of	1	
For the application of the forceps	15	
For the operation of turning	20	
For the operation of embryulcia	25	
For the Cæsarean operation	250	
For any indisposition in the mother or child after the tenth day from confinement, or when any *very serious* ailment occurs in either mother or child *within* the ten days, a charge is to be made for each visit as in ordinary cases of disease.		
Surgical Practice.		
For reducing fractures, and the first dressing	25	15 to 25
In the above and all other surgical operations the subsequent visits are to be charged as in attendance on ordinary cases of disease, the amount of charge being proportioned always to the time occupied and the trouble incurred in the subsequent attendance in each case.		
For reducing luxation of hip		50 to 100
For reducing luxation of shoulder		25 to 50
For reducing luxation of elbow, knee, or ankle		25 to 50
For reducing other recent luxations	15	10 to 25
For reducing old luxations	60	15 to 40
For amputation of a leg or arm	50	10 to 50
For amputation at the shoulder-joint	200	
For amputation at the hip-joint	250	
For amputation at thigh		100 to 300
For amputation of a finger or toe	10	
For resection of large bones and joints	150	
For resection of the smaller bones and joints	50	
For tenotomy	30	5 to 25
For the operation for artificial joint	150	
For extirpation of mammary gland		50 to 200
For the extirpation of tumors in dangerous localities	100	5 to 50
For the extirpation of other tumors	30	5 to 30
For trepanning	150	20 to 100
For extirpation of eye		100 to 150
For operation for cataract or artificial pupil	150	25 to 100
For other operations on the eye and its appendages	30	10 to 30
For the removal of polypus from the nares	30	10 to 30
For the operation for cleft palate	60	
For the operation of hare-lip	25	20 to 30
For the operation of tracheotomy	50	25 to 100
For excision of the tonsils	15	10 to 15
For excision of uvula		5
For the operation for removal of a nævus	15	

Surgical Practice. (Continued.)	Philadelphia.	Med. Soc. New Jersey.
For the introduction of the stomach-pump	$20	$5 to $25
For the ligation of the subclavian, carotid, iliac, or femoral arteries	200	10 to 100
For the removal of foreign substances from the ears, nares, pharynx, or œsophagus	25	1 to 5
For the reduction of hernia by taxis	15	3 to 25
For the operation for strangulated hernia	100	20 to 100
For paracentesis thoracis	30	10 to 50
For paracentesis abdominis	20	10 to 50
For the operation for vesico-vaginal or recto-vaginal fistula	100	25 to 100
For examination per anum or vaginam	10	
For examination with speculum	15	
For the introduction of a pessary	5	
For the removal of a polypus from the uterus or rectum	30	
For staphylorraphy		50 to 200
For the operation for fistula in ano	25	
For the operation for fistula in perineo	60	
For the operation for hæmorrhoids	25	
For the removal of necrosed bone		25 to 100
For the removal of stone from the bladder	200	100 to 200
For the palliative operation for hydrocele	10	10
For the operation for the radical cure of hydrocele	25	25
For the operation for phimosis and paraphimosis	20	5 to 30
For the division of stricture of the urethra	25	10 to 50
For the division of stricture of the nasal duct		25 to 50
For the introduction of the catheter in ordinary cases	2	2 to 3
For the introduction of the catheter in cases of obstruction	15	3 to 5
For plastic operations	150	25 to 100
For laying open abscess or sinus	5	50 c. to $5
For the administration of an anæsthetic	10	
For a post-mortem examination in a case of legal investigation	30	
For a post-mortem examination made at the request of the family or relatives	20	10 to 20

Post-mortem Examinations.

Adopted by the Camden (New Jersey) City Medical Society, also by the Camden County Medical Society.

1st. For simple view of the external cadaver $5 00
2d. Opening and examination of thoracic viscera 20 00
3d. Opening and examination of the abdominal viscera 20 00
4th. Opening and examination of both thoracic and abdominal viscera 30 00
5th. For examination of the head by removal of the calvaria and dissection of the brain meninges and medulla oblongata 30 00
6th. For examination of the head, thoracic, and abdominal viscera . 50 00
7th. Bullet and other wounds of the body to be estimated according to the time, trouble, and science involved, from ......$10 to 25 00

In the fees in cases of poisoning they waive the responsibility of fixing any particular charge, as it must be governed by the estimate of those who have devoted so much of their time to the study and practice of toxicological and chemical investigations and analyzations.

PART II.

MATERIA MEDICA AND THERAPEUTICS.

INTRODUCTION.

Materia Medica is a phrase derived from the Latin, and may be defined as the branch of medical science which treats of the *materials used as medicines*, and includes a knowledge of their origin, composition, modes of preparation, administration, and their physiological and toxical action.

Therapeutics is a term derived from the Greek (θεραπεύειν), which signifies *to attend upon;* it is the science of the *application of medicines* to the alleviation or cure of disease.

Pharmacy is the art of preparing medicines for use, and is that department of materia medica which treats of the collection, preparation, preservation, and dispensation of medicines. To facilitate a uniform nomenclature and dispensation of medicines, authoritative works have been issued in different countries, termed Pharmacopœias. These are official lists of those drugs and their preparations which are recognized by the medical profession of that particular country in which they are issued, as the Pharmacopœia of the United States (U. S. P.), the British Pharmacopœia (B. P.), etc. In foreign countries this last has the force of law, being published under governmental auspices; but in the United States it is revised every ten years, by a convention representing the medical and pharmaceutical professions. It furnishes a list of articles which are in general use, sets forth the weights and measures which are employed in dispensing and preparing them, and supplies formulæ for such preparations as should be kept in shops, and which are thence termed *officinal*, from the Latin word *officina*, a shop. The Pharmacopœia of the United States was first promulgated by the authority of a convention held at Washington in 1820, and its sixth decennial revision, in 1880, was published in October, 1882.

A *Dispensatory* is an encyclopedic treatise on medicines, and differs from a Pharmacopœia, since it includes the physical and medicinal history of drugs as well as the composition, uses, effects, and doses of medicines. It is a private publication of authority, valuable according to the reputation of its authors, and treats of drugs which, though not officinal in the Pharmacopœia of one country, may be in that of another; also giving an account of many drugs which are not officinal anywhere.

METHODS OF PREPARING DRUGS.

The United States Pharmacopœia recognizes thirty-four methods of preparing drugs for dispensation, either in the liquid, solid, or semi-solid form, and which are defined as follows:

LIQUIDS.

An Infusion (*infusum*) is made from a vegetable drug by displacement or maceration in cold or hot water without boiling.

A Decoction (*decoctum*) is made from a vegetable drug by boiling in w
for a variable length of time.

A Water (*aqua*) is a solution in water of a volatile substance.

A Solution (*liquor*) is made by dissolving a non-volatile substance in water.

A Spirit (*spiritus*) is an alcoholic solution of volatile principles made from the pure drug by distillation or direct solution.

A Tincture (*tinctura*) is an alcoholic solution of non-volatile principles prepared from the pure drug by maceration or displacement, or by dissolving the principles themselves.

Tincture of Fresh Herbs (*tinctura herbarum recentium*) are prepared from the fresh herb, bruised or crushed, by maceration with alcohol for fourteen days.

An Elixir (*elixir*) is a dilute tincture, made agreeable to the taste by the addition of sugar and some aromatic.

A Fluid Extract (*extractum fluidum*) is a concentrated preparation, so made that each minim represents about one grain of the crude drug. To this there is but one exception—the compound fluid extract of sarsaparilla. They all contain alcohol, and many glycerine, also as a preservative. The fluid extract of ergot contains dilute hydrochloric acid.

A Wine (*vinum*) is a preparation having white wine as its menstruum.

A Vinegar (*acetum*) has dilute acetic acid as its menstruum.

A Glycerite (*glyceritum*) has glycerine as its menstruum.

A Syrup (*syrupus*) is a saturated solution of sugar in water. It may be simple or compound, in the latter case being combined with other agents.

A Honey (*mel*) is a preparation having honey as its base.

A Mucilage (*mucilago*) is a solution of gum in water.

A Mixture (*mistura*) contains one or more insoluble substances held in suspension in water by the aid of a suitable vehicle. [*An Emulsion* is a mixture having an oil suspended in water by means of a gum or an albuminous substance.]

A Liniment (*linimentum*) is a liquid preparation, usually containing soap or oil, and intended for external application by rubbing.

A Collodion (*collodium*) is a solution of gun-cotton (pyroxylin) in ether and alcohol.

An Oil (*oleum*) is an oily principle, obtained by expression (fixed oils) or by distillation (volatile or essential oils).

SOLIDS.

A Powder (*pulvis*) is a drug in a state of minute subdivision, prepared by pulverization.

A Pill (*pilula*) is a small spherical body containing medicinal agents, with some excipient, as gum, mucilage, soap, etc., to give it body.

An Extract (*extractum*) is a solid or semi-solid preparation, made by evaporating either the fresh juice or an alcoholic or watery solution of the drug.

An Abstract (*abstractum*) is a dry powdered extract, which is about twice the strength of the corresponding fluid extract.

A Trituration (*trituratio*) is a very finely comminuted powder, prepared by trituration of the substance (ten parts) with sugar of milk (ninety parts).

A Pill-Mass (*massa*) is a preparation of proper consistence for making pills.

A Troche (*trochiscus*) is a medicated, gummy disk, meant to dissolve slowly in the mouth.

A Paper (*charta*) is a sheet of paper medicated for external use.

A Plaster (*emplastrum*) is made by spreading solid substances on muslin or other material by the aid of heat, and is adhesive at the temperature of the body.

A Resin (*resina*) is a principle obtained from a saturated tincture by precipitation with water.

Suppositories (*suppositoria*) are conical medicated bodies having cacao-

butter (*oleum theobromæ*) as their base, and are intended for introduction into the rectum, uterus, or vagina, where they melt at the temperature of the body.

SEMI-SOLIDS.

An Oleate (*oleatum*) is a compound of oleic acid with a salifiable base.

An Oleoresin (*oleoresina*) is an ethereal extract of a crude drug, and generally contains an oil and a resin.

An Ointment (*unguentum*) is a mixture of medicinal substances with a fatty material or with lard, for external use only.

A Cerate (*ceratum*) is an ointment having wax as its base.

A Confection (*confectio*) is composed of medicinal substances beaten up with sugar or honey, or both, into a pasty mass.

CERTAIN PREPARATIONS IN COMMON USE WHICH ARE NON-OFFICINAL.

An Enema (*clyster*) is a liquid for rectal injection.

Bolus.—A bolus is a large-sized pill.

Discus.—A disk is a medicated scale of gelatine for local use to the eye.

Granulum, Parvulum.—A granule, or a parvule, is a very small pill composed of active principles or very powerful drugs.

Dragée.—A dragée is a sugar-coated pill.

Bougium.—A bougium is a small pencil-shaped suppository having gelatine for its base, for insertion into the urethra or uterus.

Glycecol.—A glycecol is a jelly troche, the base of which is a mixture of gelatine or isinglass with glycerine, called glycecolloid.

MODUS OPERANDI OF MEDICINES.

It is now well established that the *characteristic* action of medicines is transmitted to the parts influenced exclusively through the medium of the circulation, though there can be no doubt that the functions of the nervous system may be *secondarily* excited by a local medicinal impression. The number of agents which operate in this way is, however, very limited. After their absorption into the blood, medicines circulate with it, penetrate through the capillaries to the various organs, and are afterward thrown out of the system with the excretions.

Some medicines produce changes in the condition of the circulating fluid. Others have a specific action upon some one or other of the organs of the body. And, in passing out of the body, most medicines act as excitants of the organs by which they are thrown out.

The absorption of medicines is effected principally by the veins, and in some degree also by the lymphatics and lacteals. The medicinal particles penetrate or soak through the interstices of the tissue with which they are placed in contact, and are thence diffused through the circulation. The absorption of insoluble substances can not take place until they are previously rendered soluble. In the stomach, this is accomplished partly by the agency of the acids of digestion and partly by the albuminoid constituents of the gastric fluid. Some substances are dissolved by the alkaline liquids of the small intestine.

CIRCUMSTANCES WHICH MODIFY THE EFFECTS OF MEDICINES.

The circumstances which modify the effects of medicines relate both to the medicine and to the human system.

1. The properties of medicines are modified by the soil in which they grow, by climate, cultivation, age, and the season of the year at which they are gathered.

2. Medicines are more active because more readily absorbed in a state of solution than in a solid state.

3. Soluble medicines are often rendered inert by a chemical reaction which converts them into insolubles; in this way antidotes modify the

of poisons. When the chemical composition of medicines involves their mutual decomposition they are said to be *incompatible*.

4. Differences in dose greatly modify the effects of medicines.

5. Pharmaceutical modifications have an important influence on the efficacy of medicines.

A variety of circumstances relating to the human organism modify the effects of medicines.

6. *Age* exerts a most important influence in this particular. Children are more susceptible than adults and those in advanced age; also require smaller doses than in the prime of life. No general rule can be laid down for the adaptation of the doses of medicine to different ages, as the susceptibilities to different medicines are unequal at the same age. Thus infants are peculiarly susceptible to the impressions from opium, while in the cases of calomel and castor-oil they will bear much larger proportionate doses. Unless otherwise specified, all doses of medicine are reckoned for adult patients, and must be recognized as the standard for comparison. In estimating the dose for children under twelve years of age, the following rule (Young's) will be found the most convenient: Add 12 to the age, and divide by the age, to get the denominator of the fraction, the numerator of which is 1. Thus, for a child 2 years old, $\frac{2 + 12}{2} = 7$, and the dose is one seventh of that for an adult. Of powerful narcotics, scarcely more than one half of this proportion should be used. Of mild cathartics, two or even three times the proportion may be employed.

7. *Sex*, *temperament*, and *idiosyncrasy* all modify the effects of medicines. Women require somewhat smaller doses than men, and during menstruation, pregnancy, and lactation, all active treatment which is not imperatively demanded is to be avoided. To persons of a sanguine temperament, stimulants are to be administered with caution; while in cases of the nervous temperament the same is to be observed in the employment of evacuants. Mercurials are called for where the bilious temperament exists; but, on the other hand, they are generally injurious where the lymphatic temperament is strongly marked. Idiosyncrasy renders many individuals peculiarly susceptible or unsusceptible to the action of particular medicines, as mercury, opium, etc.

8. *Disease* often fortifies the system against the action of medicine, so that the tolerance of extraordinary quantities of medicine is established. In tetanus, immense quantities of opium are borne and required; in typhoid fever, alcohol is freely administered without inducing narcotism; in pneumonia, tartar emetic may be taken in large doses without inducing nausea.

9. The *time of administration* modifies the action of medicines. Where a rapid effect is desired, they are to be given on an empty stomach; on the other hand, irritant substances, as the arsenical or iodic preparations, are best borne when the stomach is full; and the insoluble chalybeates, requiring the gastric fluid to dissolve them, should be taken with the food.

10. The *condition of the stomach* is to be considered in prescribing medicines. In the black vomit of yellow fever, absorption can not take place by the stomach; and in the second stage of cholera, endosmosis by the bowels is impossible; in such cases hypodermic medication is invaluable.

11. *Habit* diminishes the influence of many medicines, especially narcotics, while the influence of *race*, *climate*, *occupation*, and the *imagination* upon the effects of medicines is often decided, and requires attention in prescribing.

PARTS TO WHICH MEDICINES ARE APPLIED.

All medicines except those designed to produce a mere *topical* or *local* effect must gain entrance into the circulation before the *remote* or *constitutional* effects can be brought about. The most available routes by which the latter result can be established are by the stomach, the rectum, the integu-ent, the subcutaneous tissue, the respiratory tract, and by intra-venous ection.

1. The *stomach* is the route most frequently used. When it is empty, and its mucous membrane healthy, crystalloidal substances in solution pass through the walls of its vessels with the greatest rapidity. Colloidal substances (fats, albumen, gum, gelatine, etc.) require to be digested and emulsified before they are absorbed.

2. The *rectum* absorbs most readily the salts of the alkaloids in solution, especially those of morphine, atropine, and strychnine, the latter more quickly than the stomach. The rectum also absorbs acid solutions of medicines if not too frequently repeated. Medicines are administered "*per rectum*" to relieve disease of this or neighboring organs, to occasion revulsion, to produce alvine evacuations, to destroy ascarides, and when for any reason it is desirable to spare the stomach. It is usually recommended that the dose of medicine used in this way for constitutional effects should be two or three times greater than when taken into the stomach. In the case of active soluble medicines, however, especially narcotics, it is most prudent to give the same amount by the rectum as by the mouth; ordinarily the dose should be one fourth greater.

3. The *integument* is capable of absorbing certain medicinal agents, and medicines may be applied to the skin for both a local and a general effect. When brought in contact with the skin without friction, it is termed the *enepidermic method*. Solutions of medicines in water permeate slowly through the skin to enter the vessels. The oily excretions of the sebaceous follicles of the skin prevent the contact of aqueous liquids with the cuticle, but the cuticle itself is the main impediment to absorption. It is known that chloroformic solutions of the alkaloids placed in contact with the skin readily produce these effects upon the system. The chloroform quickly osmoses through the skin, carrying with it dissolved substances. The application of medicines to the skin by *friction, the epidermic method*, is occasionally resorted to. Fatty or oleaginous materials increase absorption in this way, and glycerites and oleates may be thus employed. But, as a general rule, the results of this method are slow and uncertain. A more rapid and certain method of affecting the system through the agency of the skin is to apply the medicine to the dermis denuded of the cuticle. This is termed the *endermic method*, and the cuticle is usually removed by a blister. The medicine is applied in the form of a powder, which, if too irritating, should be incorporated with gelatine, lard, or cerate. The method is useful in cases of irritability of the stomach, of inability to swallow, or when we desire to influence the system rapidly and by every possible avenue, or where it is important to apply the medicine near the seat of the disease. The dose is to be two or three times greater than the amount given by the stomach. This method, however, is slow, painful, and disfiguring, and can not be often repeated, and so has been almost entirely superseded by the *hypodermic method*.

4. The injection of medicine into the *subcutaneous cellular tissue* is of recent introduction in therapeutics. Medicines are injected hypodermically for both local and general effects. A constitutional impression can be produced by this means more certainly, rapidly, and efficiently than by the introduction of medicines into the stomach. It is particularly adapted to the speedy relief of pain, to the treatment of diseases in which it is desirable to influence the system with the greatest possible rapidity and effect, and also to cases where the internal administration of medicine is interfered with. The substances proper for hypodermic injection are those which are small in bulk and of perfect solubility, such as the vegetable alkaloids, the most available of which are morphine, atropine, and strychnine; such medicines should not be too irritating. The medicine must be in a state of solution, and is thrown in by a hypodermic syringe. The usual menstruum is distilled water, and the solution should be of neutral reaction and freshly made. To preserve hypodermic solutions from the destructive action of a low order of vegetation (algæ), a weak solution of borax or salicylic acid may be used Care must be taken to avoid puncturing a vein. The most suitable localitie

are the arms, abdomen, thighs, back, and calves of the legs. Irritating injections are best tolerated in the back. Dose, one fourth less than by the mouth.

5. Medicines are applied to the *broncho-pulmonary mucous membrane* by the insufflation of powders into the nares, fauces, larynx, etc., by the nasal douche, and by inhalation of vapors or atomized fluids.

6. Medicines may be *introduced into the veins;* but only in emergencies is any such procedure admissible, as the operation is highly dangerous. *Saline solutions* in the collapse of cholera, diabetic coma, etc.; a solution of *ammonia* for the bites of venomous snakes; chloroform, asphyxia; opium, narcosis; hydrocyanic acid, poisoning, etc.; and *transfusion* of blood or milk as a last resort in hæmorrhage, epilepsy, uræmia, the collapse of cholera, etc., —are the instances which are admitted in practice.

THE CLASSIFICATION OF MEDICINES.

Different modes of grouping drugs have been adopted in the text-books of materia medica, hardly any two of them presenting precisely the same classification. Some writers have classified them according to their natural properties; others, according to their action on the system. To the student of medicine a classification based on the sensible qualities, or natural affinities, is misleading and fallacious, and can be of little value, since it associates articles of the most opposite remedial properties. By some authors the preference is given to the purely physiological plan, by which all the medicinal substances having a *particular action* are placed under that special heading. Thus we have purgatives, narcotics, astringents, diuretics, etc., as different varieties, with their attendant species. Undoubtedly such a plan has the merit of scientific precision; and had each drug only one medicinal action, nothing could be simpler or more desirable than that arrangement. The objection to this, the usual classification of the text-books and of lectures upon this branch of medicine, is that it is too apt to mislead the student in the belief that there is a greater resemblance between certain articles of the materia medica than really exists in nature. It should, therefore, be understood that all classifications are to a certain extent artificial, and have been thus arranged for convenience, and not because the articles under each class are precisely alike, but because they resemble one another in some one or more important features, while in other respects they differ greatly. No two medicines, even in the same class, are precisely similar; and, in acquiring a knowledge of them, a study of the points of difference is even more important than those in which they resemble one another. Another important element of complication is introduced by the fact that the same drug may act in many and opposing ways. Thus, while opium is an astringent, it has every right, under certain circumstances, to be called a purgative. Its stimulant action is as evident as its hypnotic influence; it is likewise a diaphoretic, a sedative, and an analgesic, or a remedy that will relieve pain. Not only opium, but many others of our most important drugs behave in the same way; and, were each drug included in each class, according to its diversified properties, it would cause much confusion in searching it out from among its various headings. It is deemed best, therefore, to classify each drug according to its most conspicuous properties. Such a plan is greatly to be preferred to that adopted by the United States Pharmacopœia, an arrangement by which all substances are placed alphabetically; for, besides the incongruity of associating remedies of diverse properties, it hinders the student from making a choice of the best remedy designed to act in a given direction, which is otherwise greatly facilitated when such remedies are properly grouped or arranged, together with reference to their most important properties. A systematic classification serves to aid the memory. In other words, to use the trite expression of Professor H. C. Wood, it may prove "a convenient row of pegs upon which to hang our ideas and facts," so that they may be easily retained, and be easily accessible when wanted. For the above reasons, there is no question that a

classification of medicines, founded on a similarity of action on the animal economy, is most desirable and useful, and various arrangements of the materia medica have been attempted on this basis. They are all to a certain extent imperfect, which is owing partly to the diversified effects of medicine, and partly to our ignorance of the real nature of many modifications which they produce upon the tissues. Still, the advantages of some system of classification which may embrace the physiological action and clinical uses of drugs are so numerous that it can not well be dispensed with. The following general classification, fashioned after the one presented by Professor John B. Biddle, of Philadelphia, will be found to include the more ordinary and generally recognized divisions of the materia medica, and to present the articles in convenient groups for therapeutic application.

According to this system, the various classes of drugs are considered under four main divisions, as follows:

I. *Eliminants*, or those which have a special influence on the excretions:

Emetics,	Diuretics,
Cathartics,	Expectorants,
Diaphoretics,	Emmenagogues.

II. *Hæmatics*, or those which modify the blood:

RESTORATIVES.—Acids,
Alkalies,
Chalybeates.

CATALYTICS.—Alteratives,
Solvents.

III. *Neurotics*, or those which have a special influence on the nervous system:

Narcotics,	Tonics,
Anæsthetics,	Stimulants,
Antispasmodics,	Sedatives,
Antipyretics,	Excito-motors,
Antiperiodics,	Depresso-motors.

IV. *Topicals*, or those which act locally wherever applied:

Digestants,	Disinfectants,
Astringents,	Demulcents,
Anthelmintics,	Emollients,
Irritants,	Protectives.

DIVISION I.—ELIMINANTS.

General Consideration.—The medicinal agents employed for the purpose of elimination are those which have a special influence upon the excretions, and, as a rule, they act by passing into the blood and through it to find exit by the glands which they excite to the performance of their functions. They include all medicines that tend in a direct manner to increase excretion, thus evacuating certain materials which should not remain in the system. Powerful eliminants, when given in excess, may produce congestion, and thus diminish excretion.

Class I.—Emetics.

Emetics are those drugs which are employed in the practice of medicine for the purpose of producing emesis, or vomiting.

Action.—The act of vomiting consists in the simultaneous spasmodic contraction of the diaphragm and abdominal muscles, and relaxation of the cardiac orifice of the stomach so that its contents are expelled. When the diaphragm and abdominal muscles contract, but the cardiac orifice remains closed so that the contents of the stomach can not escape, the expulsive efforts are termed *retching*. The nervous center, which regulates these movements, is situated in the medulla oblongata; and it may be excited, either directly by the action upon it of drugs carried to it by the blood, or reflexly by irritation of various nerves. The drugs that act directly upon it have the same

action whether they are introduced immediately into the circulation or absorbed by the stomach. They may thus produce vomiting and evacuation of the stomach without being taken into the stomach at all; and on this account they have been termed *specific* or *indirect* emetics, although they act directly upon the vomiting center. Such are ipecacuanha, apomorphine, and tartar emetic. Similarly, the drugs that excite it reflexly are still termed *irritant* or *direct* emetics, because their action requires direct application to the stomach. Such are the sulphate of zinc, sulphate of copper and alumina, carbonate of ammonia, salt, and mustard, which irritate the nerves of the stomach. Tickling the fauces with a feather or with the finger also excites reflex vomiting, and may be adopted either alone or in order to aid the action of other emetics. The terms *direct* and *indirect*, therefore, as applied to emetics, relate to the stomach and not to the center for vomiting.

Direct emetics, as they stimulate the nerves of the stomach only, have little action except that of simply unloading this viscus. The indirect emetics, which excite vomiting by their action on the medulla oblongata, act also on other parts of the nervous system, and cause secretion of saliva, secretion of mucus from the œsophagus, stomach, and bronchial tubes, and perspiration, much nausea, loss of nervous power, and muscular relaxation. And the vomiting they excite is more continuous and violent, and often expels the contents of the gall-bladder, causing part of the bile to flow into the stomach and be thus evacuated.

Uses.—Emetics are employed to remove the contents of the stomach under various circumstances: 1. When the food is causing irritation and not undergoing proper digestion, as, for example, in dyspepsia or sick headache; and in such cases large draughts of lukewarm water, of mustard, or salt and water, or an infusion of chamomile, are usually found beneficial. 2. In cases of poisoning; and here mustard, sulphate of zinc, or sulphate of copper, are the best, as they empty the stomach more quickly and effectually. 3. To cause the expulsion of bile from the gall-bladder, or remove the bile from the system in biliousness, fevers, and agues. In biliousness, excess of bile is more readily removed by vomiting than by purging, as there is no opportunity for the bile to be absorbed, whereas it may undergo absorption on its passage through the intestines. It is supposed by some that various poisons circulate occasionally in the bile, such as the malarious poison which occasions ague, and possibly other septic poisons which give rise to fevers. The advantage of emetics in ague is undoubted, as it can certainly sometimes be cured by them without quinine, and the action of quinine is always aided by their use. They have also been recommended in the earliest stages of continued fevers. In such cases, tartar emetic or ipecacuanha are most serviceable. 4. To cause the expulsion from the air-passages of false membrane in croup or diphtheria, or of excretions in bronchitis. For these purposes, ipecacuanha is the emetic most frequently chosen; but if it does not act rapidly enough in croup, sulphate of zinc or copper may be employed. In acute bronchitis, tartar emetic, in nauseating and frequently repeated doses, until vomiting finally takes place, is the surest method of cutting short the disease in its early stages. But in cases of either croup or bronchitis, where there is great depression of the circulation, carbonate of ammonia may be used with advantage, as it not only causes vomiting and facilitates expectoration, but at the same time stimulates circulation. 5. And, lastly, emetics may be employed to create a shock to the system. Under this head may be included several empirical uses of emetics, in which advantage is gained, but in a method which is not very clear. Thus, in epileptic and hysterical attacks, when the fits have a tendency to recur every few minutes, emetics will sometimes break up the succession of disordered nervous action. And sometimes a paroxysm of ague can be prevented by giving an emetic just before its expected recurrence.

Contra-indications.—"The chief contra-indications to the use of emetics are the existence of congestion of the brain, and of gastric inflammation.

"Advanced pregnancy and hernia, while they do not positively contra-

indicate the use of emetics, should cause great caution to be practiced in their employment.

Administration.—"Emetics should, as a general rule, be given in a full dose, so as to avoid unnecessary repetition, and should be administered dissolved in water or in syrup. Their action should be assisted by frequent and copious draughts of tepid water, which also has the advantage of rendering the vomiting less painful. When, for any reason, protracted nausea is desired, the doses should be small, and repeated at short intervals."

Hyperemesis may advantageously be divided into two varieties: First, due to overdoses of depressing centric emetics; second, such as arises from irritation of the stomach, as by mechanical emetics. The treatment of the first requires absolute quiet, in the horizontal position, the free use of opium enema, the application of counter-irritants to the epigastrium, and the use of alcoholic stimulant in hot water and not much diluted—raw brandy sometimes being most efficient. Creosote, chloroform, and the latter with volatile oils, are sometimes useful. When excessive vomiting is due to some irritant emetic, the stomach should be thoroughly washed out by large draughts of warm mucilage, opium given by the rectum, or morphine hypodermically, and a mustard plaster applied to the epigastrium. The swallowing of small bits of ice is sometimes of service; but no medicine should be taken into the inflamed viscus.

Class II.—Cathartics.

Cathartics are those drugs which are employed in medicine to produce purgation or increase the intestinal evacuations. Their number is large, and their action varies partly with the dose, from the mild and almost natural effect of magnesia, sulphur, or confection of senna, to the violent purging of jalap, gamboge, or elaterium. They have been divided into several groups, namely, drastic, simple, saline, hydragogue, cholagogue, and laxative. Several articles belonging to these divisions pass by insensible gradations the one into the other, according to the dose administered or the condition or susceptibility of the system.

For practical use we may include all kinds of cathartics under the head of *laxatives*, *hydragogues*, and *cholagogues*. To laxatives belong simple purgatives in small doses; hydragogues include the saline and drastic cathartics; while the cholagogues may partake of the action of either class, but usually comprise such drugs as exert a special action upon the liver.

Action.—Some cathartics operate by increasing the peristaltic motion of the intestines; others, by stimulating the mucous follicles and exhalents, and occasioning watery evacuations, are hence termed *hydragogues*. The more violent of the hydragogues, if given in overdoses, produce inflammation of the alimentary canal, characterized by violent vomiting and purging, abdominal pain and tenderness, cold extremities, and sinking pulse. From their activity they are called *drastics*. Different cathartics affect different parts of the alimentary canal irregularly—some acting more particularly on the upper portion, some on the lower, and others affecting all parts equally. Mercurial preparations purge chiefly by inducing a flow of bile (*the natural laxative*) from the liver. The increased intestinal evacuation produced by cathartics is partly due to acceleration of the peristaltic movements of the intestine, so that the intestinal contents are hurried along more quickly, and less time is allowed for their absorption. Many authorities, especially in Germany, have held this to be the only way in which cathartics act; but there is no doubt that many of them also produce increased excretion from the intestinal glands. *Laxative* and *simple* cathartics act chiefly, if not entirely, by increasing peristaltic action. Some of the *drastic* cathartics act in both ways; while the *hydragogues*, as well as the *salines*, especially increase the intestinal excretion. In case of some of the salines—as bitartrate of potash—the excretion of watery fluids is greatly increased, while the peristaltic movement is so little affected that the excretion may lie so long in the intestine as to be again reabsorbed, and the drug may therefore fail to produce purgation

all. For this reason it is usual to combine such salines with simple purgatives, which will accelerate the peristalsis.

Besides their direct action upon the bowels, cathartics exert an indirect effect upon the circulation, weakening it, and lowering the pressure of blood within the vessels, hence becoming a useful measure of depletion.

Cholagogue cathartics are those which have a special power to remove bile from the body. They may do this either by stimulating the excretion of the liver or by quickening the expulsion of bile from the gall-bladder and ducts, so that more bile is poured into the intestine at a time when this is in active movement. The bile is therefore hurried down the intestinal canal, and reabsorption is thus prevented. This appears to be the mode of action of such agents as mercurials, and euonymin, iridin, or podophyllin. Clinical experience has amply demonstrated the former to be the most efficient cholagogue that we possess. The action of all of these agents is probably not only due to stimulating the liver to an increased flow of bile, but also to exerting a special stimulating action upon the duodenum, quickening its peristaltic movements, and thus hurrying down the bile, and preventing its reabsorption. Their beneficial action as cholagogues is greatly increased by the subsequent administration of a saline purgative, which will tend to sweep the bile out of the lower part of the small and the large intestines before reabsorption can take place.

Uses.—" Cathartics are very largely used, both singly and in the most various combinations with one another, and with tonics and aromatics, from the natural salines of the mineral springs to the numerous quack compounds with which the country is flooded. They are probably more abused than any other class of drugs, since resort to them is so easy as often to lead to neglect of highly important hygienic rules. They should never be allowed to take the place of due attention to diet, exercise, and habit " (Clarke).

The indications to fulfill by the use of cathartics may be mentioned as follows:

1. " *To remove Fecal Matters from the Intestinal Canal.*—They not only prevent the accumulation of such matters, but remove the irritation which their presence produces, and which may evidence itself in disturbances of other organs; for example, headache and malaise. These disagreeable symptoms, produced by constipation, appear to be partly due to the irritation of the intestinal nerves, producing reflex disturbance of the circulation; but it is probable, also, that they may be caused in part by the toxic action of poisonous gases, liquids or solids, generated in the intestine by imperfect digestion or decomposition of the food. For such purposes as this we may employ, as we find them necessary, laxatives or simple purgatives.

2. " *To remove from the system an excess of certain excretions*, such as bile and substances which may be contained in them, or organic poisons which are excreted in the bile and intestinal mucus, or certain toxical agents which may have been introduced into the system by accident or design, and other offending materials, as indigestible or irritant food and foreign bodies. For the latter purpose, the brisk, quickly acting cathartics are generally the best.

3. " *To deplete.*—On account of the large serous flow which they produce, the hydragogue cathartics, when freely administered, cause a very decided general depletion. Local depletion by means of cathartics is called for in *congestion of the portal circulation*, as well as in *dysentery* and other intestinal inflammations. Under these conditions may be included those cases of so-called 'torpidity of the liver' most effectually relieved by cholagogues, especially the mercurial. In acute *intestinal inflammations*, the salines are to be preferred when depletion is desired, as they produce very large serous discharges without irritation.

4. " *To promote Absorption.*—By emptying the blood-vessels, the cathartics favor the absorption of the exuded fluid in general dropsy. For this purpose the hydragogues, and especially elaterium, in properly regulated doses, are the best purgatives. The production of catharsis is the surest

method of relief in general *dropsy*, also in *ascites;* in other forms of local effusion its effects are less marked. As, however, purgation is the most exhausting of all the plans employed for the cure of dropsy, due regard must always be had to the strength of the patient. It is frequently necessary actively to support, and even stimulate, while it is being carried out.

5. "*To revulse.*—The long tract of the alimentary canal affords a great extent of surface upon which to practice revulsion in certain brain diseases, as *cerebral hyperæmia*, *mania*, *rheumatic irritation of the brain*, and in the early stages of *cerebro-spinal meningitis.* In these affections they may do good by depleting as well as acting as revulsives. The hydragogues and drastics should be preferred.

6. "*To eliminate.*—There is no doubt, from clinical experience, that cholagogue cathartics, especially calomel, at the outset of typhoid and other essential fevers, may act favorably, by eliminating, through the liver and intestinal glands, some *materies morbi* retained in the blood, and thus shorten the duration and relieve the intensity of the disease. In rheumatic disease their favorable action appears to be due to something more than depletion. And, in cases of retained renal excretion (uræmia), the evidence is very decided that they do aid in separating the products of retrograde metamorphosis from the blood.

7. "*To lower the Blood-pressure.*—For this purpose they may be employed to prevent the rupture of a blood-vessel and consequent apoplexy, or to prevent further extravasation in a case where the vessel has already burst, as in hæmorrhage from the lungs. In such cases the salines are to be preferred.

8. "*To influence the Pelvic Circulation.*—But the only article to be used for this purpose is aloes, the action of which may be considered under the head of emmenagogues."

Contra-indications.—The more active cathartics are contra-indicated in cases of inflammation or ulceration of the gastro-intestinal mucous membrane, peritonitis, the advanced stages of typhoid fever, pregnancy, etc.

Administration.—The slowly acting cathartics, such as aloes, are best given at bed-time, while those which act more briskly may be given before breakfast. The operation of cathartics is promoted by the addition of small doses of emetics and of bitters. By combining those which act upon different portions of the alimentary canal, their operation is rendered less irritant, without any diminution of purgative efficiency. The griping and nauseating tendency of the drastic cathartics may be corrected by the addition of hyoscyamus extract, and of aromatics; carbonic-acid water is a grateful vehicle for administering the saline preparations. Cathartics operate more speedily and favorably when given on an empty stomach, and susceptibility to their action is diminished during sleep and increased by exercise. Mild, diluent beverages promote their operation. In the event of hypercatharsis, opium should be administered by the mouth or the rectum, and the patient kept as quiet as possible.

Enemata.—In cases of irritability of the stomach, or with the view of hastening the action of cathartics taken by the mouth, or to remove feculent accumulations in the lower bowels, or to relieve tympanitis, or for the purpose of revulsion, or the removal of ascarides, *cathartic enemata* are frequently administered.

When it is desired simply to open the bowels mechanically, tepid water, flax-seed tea, or other demulcent infusion may be employed. The common *laxative enema* consists of a tablespoonful of common salt, molasses, and lard, or olive-oil, each in two thirds of a pint of warm water; castor-oil or Epsom salt may be added to increase the cathartic effect. Senna tea or some other cathartic effusion is often employed. To relieve flatulency, oil of turpentine and asafœtida may be used. For the removal of ascarides, infusion of quassia is an excellent enema. In some cases of intussusception of the intestines, and even in hernia, much good may be accomplished by mechanically distending and unfolding the invaginated bowel by means of *forced enemata* of warm water. "In administering these large injections, a syringe should

never be used. The apparatus to be provided consist of a rectal tube of hard rubber with a conical point, having several openings on its side, an India rubber tube, two and a half feet long, fitted to the rectal tube, and a funnel. The patient should lie upon his back, with the hips elevated. The tube being introduced into the rectum, the free end with the funnel is raised vertically and water poured into it." When it is desired to force fluid into the small intestines, much depends upon the introduction being performed slowly and carefully: the patient should be placed upon his knees and shoulders, so that the pelvis may be higher than the shoulders. It is essential that the tube be provided with a stop-cock, or be compressed with thumb and finger, so as to regulate the passage of the liquid. The force is also regulated by the height at which the funnel is held. In this way from four to eight pints of water can be thrown into the bowel, filling the large intestine, and even passing the ileo-cæcal valve. Several cases of invagination have been reported in which the symptoms subsided under this treatment, the invaginated portion of the intestine having slipped back to its proper place during the distention. This method should not be resorted to when there is reason to think that sphacelus of the bowel is taking place, as it might result in a rupture.

Class III.—Diaphoretics.

Diaphoretics are those medicines which are employed to increase the excretion of sweat. When we consider the results of suppression of the functional activity of the skin, and the importance of surface elimination to the system, the importance of these agents are clearly recognized. It is well known that the perspiratory glands have a double function to perform—that of elimination of noxious materials from the blood, and that of keeping down the temperature of the body during exposure to heat.

Action.—Diaphoretics produce the desired result in different ways, which may be considered under four headings, representing as many modes of action:

1. "*By relaxing the Skin.*—There is no doubt at times a form of excretion-leakage from the skin, as well as from mucous membranes, which is distinctly paralytic in its mechanism. The colliquative diarrhœas and sweating of profoundly debilitated subjects afford familiar examples. As regards the skin, the so-called 'night sweats' of phthisis occur at such times as there is the greatest relaxation of the system—that is, during sleep. The profuse sweats of collapse may also be instanced as an example of the general truth thus enunciated. Normal processes which produce great relaxation produce great sweating; thus, during vomiting, especially if it be accompanied by much nausea, the skin pours out its excretion. By virtue of this general law, certain remedies act as diaphoretics. All of the diaphoretics which cause sweating by producing relaxation, and which are employed in medicine, are nauseants, constituting a distinct group—the *nauseating diaphoretics.*

2. "*By reducing the Force of the Circulation.*—There is undoubtedly a condition of over-action or over-rapidity of the circulation, in which the affected glands are unable to perform readily their normal functions. Thus, it is well known that the first stage of inflammation is one of arrested secretion, and that in high fever there is a general drying up of excretions. The skin does not differ from other organs in this respect; consequently, its functional activity may fail from excessive arterial action. Hence there is a class of remedies which, although perhaps not actively sudorific in health, are in disease very efficient in reducing circulation and restoring the functional activity of the skin. It is evident that there is a close connection between the present mode of influence and that noted in the previous section, and that it is no less apparent that the nauseant diaphoretics act most powerfully in reducing the circulation. But there are certain diaphoretics which reduce the circulation without being nauseants; these sudorifics form a distinct class -the *refrigerant diaphoretics.*

3. "*By entering the Circulation and directly stimulating the Glands of the Skin.*—It appears to be a general law that when any medicinal principle is eliminated by an excretory organ, the general activity of that organ is increased by the effort at elimination. Thus, the vomiting and purging of arsenical or antimonial poisoning, the increased urinary excretion following the ingestion of a potassium salt, are apparently the results of attempted elimination. The skin undoubtedly eliminates medicinal substances, and is undoubtedly subject to the general law; consequently, there is a class of remedies which increase its action by direct influence.

"It is evident that a drug may relax the general system, may diminish the force of the circulation, and also may stimulate directly the cutaneous glands. It is very probable that antimony does all of these; and at least some of the refrigerant diaphoretics may act in the last two ways. There are, however, certain substances which seem to cause sweating purely by stimulating the function of the skin. These may be termed *stimulating* diaphoretics.

4. "*By filling up the Blood-vessels.*—There is good reason for believing that precisely as, under certain circumstances, water, by increasing the amount of the blood to repletion, will induce increased renal excretion, so, under other circumstances, will it cause increased dermal excretion. The antagonism that exists between the skin and the kidneys, in regard to the amount of their respective excretions, is a matter of common observation; but it should be stated in this connection that warmth favors the action of the skin, while cold stimulates the renal activity. Thus, large draughts of water, if taken cold, the patient being kept cool, increase the urine; but if they be taken hot, and the patient covered up warmly in bed, they will increase the perspiration."

Uses.—Diaphoretics are employed in the practice of medicine to fulfill the following indications:

1. "*To arrest forming diseases* of not very severe type, probably by causing a flow of blood to the surface, and thereby relieving slight internal congestions, and possibly by eliminating principles which have been retained in the blood instead of being excreted as they ought to have been. In *general cold*, in *muscular rheumatism*, *suppressed menstruation*, and other results to exposure to cold, and of checked perspiration, the diaphoretics afford the most efficient means at our command for restoring the normal functions.

2. "*To favor Absorption.*—In dropsy, the diaphoretics are of very great value, often aiding diuretics and purgatives in effecting a cure, and sometimes, when these fail, or when circumstances forbid their use, rescuing the patient from impending death. None of the medicinal diaphoretics (unless it be jaborandi) are of sufficient power to be relied upon in dropsy. In order to reduce an effusion, the Turkish, the Russian, or the hot-water bath must be vigorously employed—the medicinal diaphoretics being used merely to aid in their operation.

3. "*To aid in the Subsidence of Diseases which naturally pass off with Sweat.*—The chief use of diaphoretics for this purpose is in *malarial fever*, especially in the *remittent* form of the affection, when the sweating stage fails to develop itself thoroughly and the paroxysms run into one another. Even in the single paroxysm of *intermittent fever*, by hastening the closing stage, diaphoretics will often shorten the paroxysm.

4. "*To eliminate Noxious Material from the Blood.*—Much of the good effected by diaphoretics in fevers is by cooling the body through surface evaporation. Modern science, however, seems clearly to point out that this class of remedies may aid in separating from the blood retained excretions, and may, to some extent, replace the action of the kidneys when these organs are disabled by disease. It has been abundantly proved that the skin excretes urea freely in Bright's disease, and also during the partial urinary suppression of scarlatinal desquamative nephritis. In diabetes the perspiration has been found to contain sugar; in rheumatism the sweat contains lactic acid, and, in jaundice, biliary products; and from these circumstar the value of diaphoretics as a means of getting rid of retained excre

becomes manifest. For this reason, in Bright's disease, especially of the acute form, they are of the greatest value, acting beneficially in three different ways: by drawing the blood to the surface, and thereby relieving internal congestion of the kidneys or other organs that may exist; by promoting the absorption of dropsical effusion; and by eliminating retained excretions."

In conclusion it may be said that, while diaphoretics are frequently employed to lower the temperature when the skin is dry and hot in febrile disease, and also used therapeutically for their evacuant, revulsive, and alterative effects, as well as to promote absorption, yet differently acting diaphoretics are requisite for different morbid conditions.

In inflammatory cases, in order to produce a powerfully relaxing diaphoretic effect, the *nauseating diaphoretics*, such as the preparations of antimony and of ipecacuanha, are chiefly resorted to, and their action is often greatly increased by the addition of opium; but their use is contra-indicated by the presence of gastric irritability. In order to allay febrile excitement, and reduce the temperature of the body without inducing nausea, the refrigerant diaphoretics should be employed. In rheumatic and pulmonary affections, after vascular excitement has been reduced, and in all cases where the surface of the body is cold, the *stimulating diaphoretics* may be employed. This group includes the diffusible stimulants, aromatic substances, generally of every class, spirit of nitrous ether, jaborandi, and many narcotics, particularly opium and camphor. *Opium*, in the form of *Dover's powder*, may be employed in inflammatory cases where other stimulating diaphoretics are inadmissible, and is given with advantage in the early stage of acute rheumatism, dysentery, and catarrh, unless the action of the pulse be very strong, when this should be previously moderated. The operation of the diaphoretic stimulants is promoted by the free use of warm diluent drinks, rest in bed, and warm covering to the body.

Class IV.—Diuretics.

Diuretics are medicines used for the purpose of increasing the flow of urine.

Action.—The excretion of urine appears to consist partly of mechanical filtration of fluid through the glomeruli of the kidney, and partly of excretion by the cells of the urinary tubules. The filtration in the glomeruli is increased by anything that raises the blood-pressure throughout the system generally, or in the renal arteries locally. The systemic blood-pressure may be raised by cold to the surface, and by the action of certain drugs. Some medicinal agents, no doubt, act directly upon the excretory structure of the glands; while others induce the increased excretion indirectly by, in some way, removing the obstacle to excretion. "It is notorious that diuretics often fail in practice when their action is most urgently needed. This results in many cases from the nature of the disease, and is not because diuretics are powerless and uncertain. Thus, in cardiac disease, the congestion of the kidneys may be so great as to render excretion impossible; and it is equally evident that, when the tubules are destroyed by Bright's disease, medicine must be powerless to provoke excretion." It is well known that the ingestion of large quantities of water, producing vascular fullness, will greatly increase the flow of urine. "Taking large draughts of simple water at regular intervals has been found to act very favorably in *acute Bright's disease*, increasing the urinary flow very greatly, and at the same time lessening the irritation of the kidneys, acting, as it were, as a demulcent to the inflamed organs. In various inflammations or irritations of the genito-urinary organs—as in gravel—whenever it is desired to make the excretion less irritating or less concentrated, the value of water as an adjuvant to medicinal diuretics should always be taken advantage of. There is certainly a very marked antagonism ·ween the bowels and the kidneys, so that free catharsis reduces very ·dedly the excretion of urine. There is also an antagonistic relation be-

tween the skin and the kidneys, so that an increased excretion from one of these generally results in a diminution of that of the other emunctory. This should also be taken advantage of when a diuretic action is desired. Sweating and purging at such times are, therefore, to be avoided. When a diuretic is administered, the patient should be kept cool, walking about if able, or, if it is necessary for him to remain in bed, he should be covered lightly." Very often a remedy which is administered cold, and the patient kept cool afterward, will act as a diuretic, which, if given hot and the patient kept warm, will act as a diaphoretic.

"Diuretics are very naturally divisible into three groups: the *hydragogue* diuretics, the *refrigerant* diuretics, and the *stimulating* diuretics. These, of course, run more or less into one another, but are sufficiently distinct for practical purposes." The stimulating diuretics include agents that have a special action on the mucous membranes of the bladder and other mucous membranes over which they pass, and are sometimes called *blennorrhetics*.

The drugs belonging to the first group simply increase the flow of water from the kidneys, and are therefore used chiefly for the relief of dropsy. Those of the second group are used to modify the excretion in one way or another, and for their sedative and eliminative action in acute disease. Those of the third group are mainly used to modify the mucous surfaces over which they pass. When the action of the kidneys is obstructed by disease of the heart, *sedatives* prove diuretic by their tranquilizing influence upon the action of this organ. In cases of obstruction of the portal system, *mercurials* increase the efficacy of the diuretics proper.

The chief indications for the use of diuretics are as follows:

1. "*To maintain the Action of the Kidneys.*—The necessity of excretion to the system renders their use for this purpose of primary importance. In various kidney diseases this indication is very urgent; but, as the lessened excretion too often depends upon a profound organic alteration of the renal excreting structure, it is evident that very frequently diuretics must fail when most needed. In the great majority of cases in which diuretics are used to fill the present indication, only the mildest of the class should be employed. Whenever there is inflammation of the kidneys, even if it be chronic, the stimulating diuretics should be avoided. When lessened urinary excretion is purely functional in its origin, diuretics are often most serviceable. In fevers, especially, is it necessary to maintain the action of the kidneys; for this purpose water should always be given freely during fever. The alkaline diuretics may sometimes be given; but the most generally serviceable of all remedies for this purpose in these diseases is the sweet spirit of nitre.

2. "*To evacuate Fluid and to promote Absorption.*—For this purpose diuretics are employed in all forms of dropsy, and are successful in direct proportion to the universality of the effusion and the structural perfection of the kidneys.

3. "*To soothe and diminish Irritation of the Genito-urinary Organs.*—The value of water in fulfilling this and the next indication has already been referred to. By lessening the acidity of the urine, and rendering soluble the uric acid which is present, the alkalies are equally important in carrying out the present and the following indication.

4. "*To alter the Urinary Excretion so as to prevent the Deposition of Calculous Material.*—Unfortunately, there is as yet no practical measure devised for dissolving a calculus when once formed. Even to alter the urine, so as to prevent further deposition, is probably impracticable, except in cases of uric-acid diathesis—the salts of potassium and lithium being the most available to meet this indication.

5. "*To exert a Stimulant and Alterative Influence.*—For this purpose the blennorrhetic diuretics may be employed as useful agents in subacute and chronic morbid conditions of the kidneys, bladder, and urethra—the most efficient agents being buchu, eucalyptus, copaiba, and other oleo-resins."

Class V.—Expectorants.

Expectorants are medicines that possess the power of facilitating the removal of excretions from the respiratory passages, and of influencing the inflammatory conditions of the respiratory mucous membranes.

Action.—There are various and even opposing methods by which drugs act upon the pulmonary surfaces. "In certain states of the latter, as in the first stages of acute bronchitis, the irritation of the part is too great for excretion, the first stage of inflammation being, as is well known, connected with suspension of function; in this condition the so-called *sedative* expectorants are indicated. These are remedies which lower arterial action; they are all nauseants, and the increase of bronchial excretion by them is analogous to that which they produce in the skin. In order to get their full effect, they must be given in nauseating doses; and, if these are gradually increased until emesis is induced, the fullest therapeutic influence is obtained." There are other drugs, which may be termed *stimulating* expectorants, and which act directly upon the bronchial mucous membrane, some of them, perhaps, increasing excretion, but most of them rather modifying it, and some of them even diminishing it by toning up a relaxed over-excreting mucous membrane. "There are some agents which facilitate expectoration by acting upon the respiratory movement—such as carbonate of ammonia, strychnine, nux vomica, and belladonna—and are highly useful in cases of debility, as they stimulate the respiratory nervous center in the medulla oblongata, as well as assist the failing circulation. They may advantageously be combined with the different stimulating expectorants." Some drugs, which can hardly be called expectorants, are nevertheless useful in bronchial diseases; thus, gallic acid will often lessen the large quantities of mucus excreted in *bronchorrhœa*, or, when the mucus is tenacious, in *chronic bronchitis;* alkalies will frequently be of great service by rendering it less viscid, and thereby facilitating expectoration. In many cases of disease occurring in the very young and in the very old, mucus may so accumulate in the lungs, owing to inability of the enfeebled powers to force it up, as seriously to embarrass or even fatally affect respiration. "Very frequently, in acute cases of this character—such as the *suffocative catarrh* of infants—mechanical emetics are of the greatest service; but in chronic cases they induce so much disturbance of digestion as to render their use dangerous, and alcohol, the terebinthinates, carbonate of ammonia, and other drugs which increase the bronchial muscular power or activity, have to be relied upon. Again, in certain conditions of the lungs, especially in *chronic catarrhal pneumonia*, potassii iodide, ammonii iodide, and other alteratives, may be of great value in facilitating the absorption of exuded materials; yet these remedies can hardly be called expectorants. It may be affirmed that the value of true expectorants in acute *pneumonia* of any variety is exceedingly doubtful, and in the chronic varieties they often do far more harm by deranging the digestive function than they do good by influencing the lung-tissue. There are several substances, chief among them being morphine, hyoscyamus, hydrocyanic acid, and gelsemium, which have the power of allaying cough by their anodyne action. But, in regard to morphine, its power of checking excretion and of blunting the susceptibility of the respiratory surfaces should be remembered, but should not prevent its judicious use. These narcotics are especially useful when the cough is disproportionate to the amount of inflammation." When large quantities of mucus are being excreted in debilitated subjects, their use requires caution, for fear of benumbing the mucous surfaces and nerve-centers which govern respiratory movement, and thereby increasing the danger of suffocation from accumulation of phlegm in the lungs.

Uses.—"Expectorants may be arranged under two heads: the *nauseant* or sedative and the *stimulating* expectorants; and the general proposition may be laid down that expectorants of the first variety are to be used in the first stages of acute bronchitis, while those of the second variety are to be employed in the advanced stages or in the chronic forms of the disease. As

these diseased conditions gradually merge into one another, so must the practitioner balance the ingredients of his expectorant mixtures, adapting their relations to the individual case."

We should, therefore, bear in mind that the leading indication for the use of *sedative* expectorants is when there is congestion of the respiratory passages, with very scanty, tough expectoration, an elevated temperature, and dryness of the skin—as in commencing bronchitis. In such cases, when dry râles are heard abundantly, with few or no moist râles, the patient often coughs until quite exhausted, but expectorates scarcely anything. Under these circumstances the administration of sedative expectorants renders the excretion from the respiratory passages more fluid, abundant, and easy to expectorate. When these expectorants do not succeed in ordinary doses, their action may be much assisted by the administration of a purgative or, still better, by giving ipecacuanha or tartar emetic in such a dose as to produce sickness and vomiting. "When the distress of the patient is great, the abstraction of a small quantity of blood, by cupping or by venesection, may give great relief. The inhalation of steam alone is also beneficial, and the air of the patient's chamber should be kept warm and moist. Stimulating expectorants do more harm than good when administered in the conditions just described, but are beneficial when the acute symptoms have passed away, as evidenced by a reduction of pulse and temperature, with a moist condition, instead of dryness of the skin." When this is the case, but the expectoration is tough and somewhat scanty, the alkaline preparations with squill become useful expectorants; but, when the expectoration is loose and abundant, the resins and balsams, and especially copaiba, tolu, and eucalyptus, are to be preferred as likely to prove of most service.

Class VI.—Emmenagogues.

Emmenagogues are medicines which are employed to establish and to increase the menstrual flux.

Action.—"As the stoppage, scantiness, or non-appearance of this excretion arises from very different causes, and as these causes are of diverse and of even opposite natures, it follows that many remedies of very different character may act as direct or indirect emmenagogues. Thus amenorrhœa may depend upon plethora, or it may be the result of anæmia; and while in the one case depletory measures would be indicated, in the other case tonics are no less essential. There are probably no articles which exert any specific influence upon the catamenia, as the discharge from the uterus is not one of the excretions through which medicinal agents pass out of the system. Medicines, however, which excite the pelvic circulation, and stimulate the organs in the vicinity of the uterus, have a tendency to excite or increase the menstrual discharge. The emmenagogues may be conveniently arranged into three groups: the *tonic* emmenagogues, the *purgative* emmenagogues, and the *stimulant* emmenagogues."

The most important agent of the first group is iron. By far the larger number of cases of *amenorrhœa* are associated with or dependent upon anæmia, and are therefore benefited by chalybeates. This agent should be given in full doses until the anæmia is relieved, or the inability of the remedy to effect such change is demonstrated. It is very rarely proper to rely solely upon the iron, and hence it is usually combined with other agents which give tone to the nervous system and those which, by irritating adjacent parts or organs, induce a stimulating influence upon the uterus by reflex action.

"Myrrh has some reputation as a tonic emmenagogue; but as it is always employed in combination with other more active medicines of its class, the influence it exerts is somewhat uncertain. It should be employed in atonic uterine conditions, and is said to be especially valuable when chronic pulmonary complications exist." The preparations of it most used in amenorrhœa are the compound pills of iron, the compound mixture of iron, and the tin-ure and the pills of aloes and myrrh. Agents which give tone to the n

ous system often greatly assist the action of iron; for this purpose, extract of nux vomica and ergot are sometimes employed.

Of agents belonging to the second group, aloes and black hellebore are perhaps the only ones employed, though mercurials sometimes prove emmenagogue from their influence in exciting excretions generally.

Aloes are generally believed to act as emmenagogue solely by virtue of their stimulant action upon the rectum. They are especially useful when *atonic* amenorrhœa exists with constipation. Ordinarily they should be given in repeated doses (three times a day), of such size as will produce daily one or two soft semi-liquid stools. At the menstrual period, advantage may sometimes be derived from the administration of a full purgative dose. They are almost always given in combination, especially with iron, whose tendency to produce constipation they prevent. In *plethoric amenorrhœa*, when torpidity of the bowels is present, salines with bromides and vascular sedatives, instead of alotic purgatives, should be employed. Formerly, black hellebore was used as a purgative emmenagogue; but it is now but rarely if ever employed. Among stimulating emmenagogues are included many of the diuretics, such as savin and cantharides; apiol and guaiacum are also used. These agents are often combined with those belonging to the other groups of emmenagogues, as tending to render their action more certain and efficient. With the stimulating emmenagogues may also be reckoned the *permanganate of potassium.* Its therapeutic action for this purpose is a recent discovery of Drs. Ringer and Murrell, of London. They have shown that this remedy is remarkably certain in the treatment of *amenorrhœa.* If given in doses of two to five grains three times a day for several days preceding the menstrual molimen, it is quite sure to establish the flow in those cases characterized by torpor, anæmia, or deficient activity of the menstrual apparatus. As an excitant to the menstrual flux, it is regarded by T. Gaillard Thomas and Roberts Bartholow as the best remedy which has yet been discovered, if applied in suitable cases. It is contra-indicated whenever an acute congestion or a general condition of sthenic reaction exists, as it is also in mechanical dysmenorrhœa. This agent is best given separately, and dissolved in pure water.

Division II.—Hæmatics.

General Consideration.—Hæmatics comprise those agents which pass into and exert an influence over the blood itself, causing a change; thus, by promoting a curative action, either by supplying a deficiency or destroying a morbid influence in the blood, counteracting chronic disorders.

The diseases for which hæmatics are used *originate in the blood*, either from a deficiency of some one or more of its constituents, or the presence of some material causing a morbid process. Hæmatics have both a destructive and reconstructive action—both, however, tending toward a healthy blood standard. Their effects are often slowly produced, but are durable in character. They are separated into two important divisions with reference to their mode of action—namely, *restoratives* and *catalytics.* The restoratives are by nature in the blood, and supply to the nutrient fluid, or cause to be supplied, materials which may be defective in our dietary, and, while present in the blood, cure or tend to cure the disease dependent upon that deficiency. The catalytics are antagonistic to certain diseases, by counteracting a morbid influence in the blood; but being foreign to this fluid, they must pass out of the system.

Class I.—Restoratives.

In this class we may group the acids, alkalies, and chalybeates. All the acids have the property of increasing the acid condition of the blood, or, more strictly speaking, of diminishing its super-alkalinity.

Action.—Acids probably lessen the alkalinity of the blood and increase its acids rather by setting free another acid than by a direct action on that id; for by the time they enter the circulation they are themselves converted

in a great measure into salts by the various alkaline secretions with which they have come in contact.

Uses.—The influences of acids in checking hæmorrhage may often be resorted to, as there is no doubt that coagulation of fibrine in the vessels is prevented, and its fluid condition normally maintained and encouraged, by an alkaline condition of the blood. The tendency to hæmorrhages in various morbid conditions—such as scorbutus, purpura hæmorrhagica, typhoid, typhus, and malignant fevers—is perhaps due to a super-alkalinity of the blood; and hence, in these affections, the dilute acids, especially organic acids, are clearly indicated. Acids have proved to be excellent remedies in checking high temperatures, though their mode of action has not been explained; but of their practical efficiency there exists no doubt. In tropical and subtropical climates, acids and sub-acid fruits are instinctively craved and largely used for their heat-lowering properties.

The dilute acids are used in fevers, not only because they reduce the pulse and temperature, but also for their refrigerant effects in relieving the dryness of the mouth and diminishing thirst, by increasing the secretion of saliva. Under like circumstances the organic acids—acetic, citric, and tartaric—when combined with alkaline carbonates in a state of effervescence or otherwise, form agents which act on the skin and kidneys.

Of alkaline restoratives, one of the most useful is *phosphate of lime*. This agent is especially useful during the period of growth. Overworked individuals, either from physical labor or mental strain, as well as over-suckling mothers and growing infants, are benefited by this agent. It is most beneficial in defective osseous nutrition and in fractured bones in pregnant women. There are other important alkaline hæmatics which should here be mentioned. Soda is a natural constituent of the blood. As chloride of sodium it forms an important addition to our food. "Its decomposition furnishes hydrochloric acid to our gastric juice, and soda to our bile salts." And it is so instinctively craved, both by animals and savage tribes, that they will travel several hundred miles to obtain this coveted addition to their food. Potash is a normal constituent of muscle, and is a valuable hæmatic in lithiasis. In pernicious anæmia, the liquor potassæ has effected a cure when other agents had signally failed.

But of all restorative hæmatics, *iron* is to be regarded as the most important. It is a normal and necessary constituent of the body, chiefly present in the red corpuscles of the blood, though then only to a limited extent. By its use we can increase the amount of hæmoglobuline, upon which the chemical interchanges conducted by the red blood corpuscles depend. Under its use, in anæmia, the cheeks grow rosy, the lips recover the usual color, the eye brightens, there is a general increase of body-weight, a development of muscle, and a heightened condition of nerve-action. In this way, tone is given to every part of the system, every organ performing its functions more efficiently under the influence of the stimulus of iron—of blood once more rich in one of its most important constituents. Digestion not only becomes more perfect, but nutrition is markedly advanced by its presence in the fluids of the body. This is often shown by the improvement of a feeble heart under a course of chalybeates. One remarkable thing about the action of iron is its effect upon the dyspnœa of chlorotic girls and other individuals. "In these cases there is pallor, amounting often to waxiness, from absolute diminution of the number of red corpuscles, and marked shortness of breath on exertion, from lack of these oxygen-carriers; there is general loss of body temperature from imperfect combustion or oxidation, while what ought to have been burnt is stored up as fat. In such cases a course of iron soon induces a change, and restores matters to their normal condition. It must, however, be borne in mind that when the blood is either broken down, or its formation hindered by some blood poison, iron will not cure the anæmia unless combined with some specific remedy to the poison in each case. For instance, in lead-poisoning, iodide of potassium is absolutely requisite for good blood-formation; in syphilis, mercury; in malaria, arsenic or quinin

should be added to the iron. Often, in fact, these specifics are true hæmatics by destroying the poison which is exerting so injurious an influence upon the blood" (Fothergill). If iron is given to healthy persons for a long time, it ordinarily produces plethora—that is, an excess of red blood corpuscles. When given to anæmic persons, it raises the condition of blood to that of health. "But after a time the blood appears, as it were, to become saturated with it and ceases to assimilate it." In certain chronic conditions, however, it is very difficult to reach any point of saturation, and iron in many cases may be usefully continued for an indefinite length of time. Iron in all its forms is useful; but as iron is iron, its preparations are unnecessarily numerous. Much difference of opinion exists as to the best forms of iron for ordinary use. It is perhaps better, in convalescence, to commence with the lighter preparations, and afterward change to the stronger forms. When iron appears to be too heating, constipating, and to produce headache, it should be combined with purgatives. For a permanent prescription, requiring to be continued for months, a pill is the best form for its administration. For hæmatic effects, iron by hydrogen, taken after meals, is to be recommended. For hæmatic and tonic effects, the astringent preparations should be employed. Where a digestive tonic and hæmatic effect is desired, the association of iron with arsenic, capsicum, and aloes is to be recommended. Sometimes iron is better assimilated when given in a state of dilution with large quantities of water, which accounts for the beneficial effects of chalybeate springs. The large draughts of water, by removing "waste" material from the system, pave the way and invite the assimilation of iron. Iron should be taken after meals, and after each dose from a half-pint to a pint of water, which it is claimed will "often make all the difference betwixt no benefit and the most satisfactory treatment." Under these and other circumstances, water itself is a true hæmatic, as it not only enters largely into the composition of the blood, but, when supplied freely to the system, causes a removal of waste material, which may hinder histogenesis.

Class II.—Catalytics.

In this class we include *alteratives* and *resolvents*. The term alterative is employed in medical conversation and in certain manuals of materia medica in a somewhat obscure manner. These agents may be defined as substances which are employed by practitioners of medicine to affect certain diseases connected with the process of nutrition, and which do not, in the doses commonly used, produce any other obvious symptoms. "These drugs may neither stimulate nor depress, so far as can be perceived, any function of the body; their action may be silent and imperceptible—but their therapeutic effects are among the most assured of clinical facts" (Wood).

Action.—Healthy nutrition depends on the digestion of the food, its assimilation by the tissues, the decomposition of the tissues during the exercise of their functions, *and the removal of their waste products being performed* in a proper manner—in due proportion to one another. If the food is not properly digested, as in dyspepsia; or is not properly assimilated, as in diabetes, if the tissues break up too rapidly, as in fever; or if the waste products are not properly removed, as in some cases of kidney disease—nutrition suffers. Digestion and excretion may be improved by tonics, purgatives, and diuretics; but alteratives seem to exert their action upon assimilation and tissue-change, and derive their name from their power to *alter* these processes, when of a morbid character, and to restore the nutrition of the body to a healthy condition. "The digestion of food is effected by means of ferments, such as those of the salivary glands, stomach, pancreas, etc. Some of the changes, such as the conversion of glycogen into sugar, which the food undergoes after absorption into the liver, and even certain so-called vital actions, such as the coagulation of the blood, are also produced by a similar gency. It is not improbable that the histolytic changes in the tissues are kewise effected by ferments. They do not depend upon oxidation, for,

although during health the products of tissue decomposition are oxidized as fast as they are formed, yet, under certain circumstances, the tissues are split up so rapidly that the products they yield are only partly oxidized. This is seen in arsenical poisoning, and by antimony, and still more markedly by phosphorus, where such tissues as the muscles become decomposed, yielding nitrogenous substances—such as leucine, tyrosine, or urea, and fat. The former are excreted in the urine, while the last, instead of undergoing combustion, accumulates in the place formerly occupied by the muscular tissue, which, accordingly, is said to be in a state of fatty degeneration. It is possible, then, although by no means certain, that alteratives influence nutrition, either by modifying the activity of ferments, or by altering the susceptibility of tissue to their action" (Brunton). It is probable that some alteratives act by modifying the character of the nutritive materials carried by the blood to the tissues, while others act in promoting the destructive metamorphosis of tissue outside of the blood-vessels. "In the latter process, the diseased tissues, being the more weakly organized, experience the earliest effects, and in this way the good may be obtained without the evil." The principal substances used as alteratives are iodine and mercury, and their respective combinations with potassium and other substances. Arsenical preparations are also used as alteratives in small doses.

Mercury has a peculiar power of breaking up newly formed fibrinous and particularly syphilitic deposits. Iodine, iodides, and probably chlorides act upon the lymphatic system and promote absorption. Antimony, arsenic, and phosphorus especially affect the nervous and cutaneous system.

Uses.—Mercury, iodine, and arsenic are mostly employed in chronic diseases, and cutaneous, scrofulous, and syphilitic affections. Mercury, in alterative (that is, small) doses, which are absorbed into the circulation without purging, is used to break up newly deposited fibrinous masses, as in iritis pericarditis, and to counteract the effect of syphilitic virus in the lymphatic glands by producing fatty degeneration of the rapidly forming or proliferated cells, and is most useful in the secondary stage of this disease. Iodine and the iodides act on the lymphatic system, and are useful in removing lymphatic swellings. By stimulating the absorbent system, they may also assist in the removal of the fibrinous deposits and syphilitic growths disintegrated by mercury. The iodides are sometimes given in the secondary, but are still more valuable in the tertiary, stage of syphilis. Arsenic is also a powerful alterative, and, like mercury and iodine, is eliminated by the principal excretory organs of the body—a fact which helps to explain the efficiency of all three of these agents, as, by the more perfect elimination of waste material which they induce, a more perfect nutrition of the body is secured. "Many other substances are now used as alteratives in small doses, the effect being more or less immediate and temporary, or slow and lasting, according to the dose administered. Many powerful medicines, given in frequent and small doses, may be called alterative, accordingly as they act continuously, gently, and slowly, and, when well selected, often most efficiently. Each medicinal substance acts in proportion to the frequency and potency of the dose administered; for this reason many agents, whose operations are mild and efficient in small doses, may be converted into active and violent poisons when given in large quantities" (Clarke). If pushed too far, the alteratives soften and even destroy the textures, impoverish the blood, so as to interfere with the function of nutrition, and produce a condition of marasmus and cachexia. Owing, therefore, to the injurious results which follow the prolonged administration of alteratives, they are to be given with caution, and their effects closely watched.

Solvents are certain agents which, when taken into the blood, exert a liquefacient action upon the blood, neutralizing any excess of acid with which it may be charged, and renders the urine alkaline. For this purpose, drugs are employed which are called antacids.

Uses.—They may be used as *antilithics*—that is, for neutralizing li- acid when it is separated in undue quantity by the urine; but the

improper when there is a deposition of phosphates, this being best prevented by the use of benzoic, citric, or the dilute mineral acids. And in treating cases of uric-acid deposit, it is unnecessary to render the urine more than neutral, as, if it be made alkaline, the phosphates formed may be deposited around the uric-acid calculi. In the treatment of acute rheumatism and gout they act by neutralizing the excess of acid with which the blood is charged in these diseases. They may also be employed to relieve irritability of the urinary organs whenever dependent, as is often the case, on excess of acid in the system. For all these purposes they should be administered in a state of large dilution, with a view to facilitate their absorption, and to prevent an irritant and purgative effect upon the bowels. For the purpose of preventing the formation of emboli, and to hasten their solution in the blood, carbonate of ammonia has been employed, or the intra-venous injection of diluted aqua ammonia, in desperate cases, has been urged as a justifiable and rational procedure. The long-continued use of the alkaline solvents disorders the function of digestion and nutrition, produces a chronic deterioration of the blood, and sets up a cachectic condition somewhat analogous to scurvy.

Division III.—Neurotics.

General Consideration.—Neurotics are those agents employed in the practice of medicine that exert a special influence on the nervous system. They pass through and from the blood (without causing a change in it, and, being foreign to it, must pass out) to the nerves or nerve-centers, there exerting a marked but transitory influence. They are rapid in their effects. They act by contact with the nerves, but produce no lasting change in the nerve-fibers. They counteract the symptoms of temporary emergencies rather than disease. They may be separated into three main divisions with reference to their effects—namely, *narcotics*, *stimulants*, and *sedatives*. The agents of the first division usually exalt nerve-force and afterward depress it. They also exert a special influence on the intellectual part of the brain. Those of the second division pass into the blood and thence to the nerves or nerve-centers, acting so as to exalt nerve-force in a general or special manner. While those of the third division directly depress nervous force, either general or particular. Their action for a time is very energetic, deranging or destroying nervous power. They have little or no effect upon the intellectual part of the brain, but act on the organic functions which are necessary to life.

Class I.—Narcotics.

This class includes all those medicinal agents which impair or destroy nervous action. When taken into the blood they affect all parts of the nervous system, but especially the higher nervous centers in the direction of paralysis. "A primary stage of stimulation sometimes precedes the true narcotic effect; but much of what is called stimulation—as, for instance, the noisiness or restlessness of alcohol—is in reality the beginning of narcotism, being due to the gradual removal of the restraints imposed by the higher faculties, by custom or timidity, upon the lower impulses" (Clarke). In the latter stages of narcotism, the faculties of sensation, of voluntary and of reflex motion, are abolished, and death may result from paralysis of the centers which govern the circulation and respiration.

The effects of narcotics depend upon the quantity administered and the condition of the system at the time the drug is taken. Often the primary stimulant effect of narcotics may be made available for therapeutic purposes; but they are more often exhibited for their sedative influence upon the motor, sensory, and intellectual functions. In diseased conditions, and as a result of habit, a marked tolerance of this class of medicines is established, so that large doses may be taken without inducing narcosis. They are employed iefly to allay pain, to induce sleep, or to affect some special nervous center. ıen employed to relieve pain, they are termed *analgesics;* when employed

to induce sleep, *hypnotics*; and when used for the purpose of inducing a dilatation of the pupil, they are termed *mydriatics*. We may therefore consider narcotics under these three headings, according to their most conspicuous properties:

Order I—Analgesics.—This group of narcotics comprises those drugs whose chief clinical use is to relieve pain. Of course, the anæsthetics might be considered under this heading; but, as they make a very marked group by themselves, they are best considered as a separate class. The only drug, besides opium, which seems worthy of a place in the present division, is cannabis Indica.

Action.—In detail, the physiological action of opium in moderate doses may be stated as follows:

The cerebral functions are stimulated, accompanied by an agreeable exhilaration of the intellectual faculties, followed by drowsiness, consciousness being finally lost in sleep, the latter sometimes disturbed by dreams. The pupils are greatly contracted, but, if death approaches, they become widely dilated, the reflex function of the spinal cord is diminished, and, in lethal doses, destroyed, death taking place from paralysis of the respiratory center: the heart's action becoming slower and fuller, the slowing being due to a depressing influence on the cardiac motor ganglia; at the same time the arterial tension is raised; the respiration tends to become slower; all the excretions are lessened, except that of the skin, which is heightened. The unpleasant after-effects of this drug are commonly symptoms of depression, as headache, nausea, constipation. In some persons, itching and miliary eruption of the skin occur. The tendency to death from *excessive* quantities of this agent is shown by the *coma* growing more profound, the *respiration* more slow, imperfect, or interrupted, the *pulse* more rapid and more feeble, the *countenance* more pallid or cyanosed, while the *skin* becomes cold and moist, or finally covered with a clammy sweat.

Of all the articles of the materia medica, opium enjoys the widest range of therapeutic application. "As an analgesic, opium appears to lessen the conductivity of nerve-matter of fibers probably as well as cells, and so diminishes the force of each impression, as experienced in the lessened pain produced by a comparatively small dose, even when not equal to arresting entirely the transmission of the impression. In large doses the impression is so lost in transmission that it is no longer felt as pain, though still sufficient to maintain a condition of wakefulness in the cerebral cells. A still larger dose of opium is sufficient to neutralize all consciousness of the pain-exciting impression, and to arrest the unfelt perturbations in the cerebral cells, and sleep is secured." In this analgesic action, opium is markedly superior to chloral. "In conditions of sleeplessness due to pain, chloral is of comparatively little or no value, while opium is the agent to be relied upon. When the painful state is due to vascular excitement or an inflammatory condition, the addition of direct vascular depressants is indicated." (Fothergill.)

From this property of assuaging pain and inducing sleep, opium is useful in almost all diseases, and it is positively *contra-indicated* only where there is a tendency to apoplexy or coma, or where there exists an idiosyncrasy with respect to its effects.

Uses.—The chief indications for the use of opium may be stated as follows:

1. "*To relieve Pain.*—As an analgesic, opium is without a rival in the materia medica, except it be the anæsthetics. It is used to allay pain from any cause whatever, except acute inflammation of the brain, and is preferred to the anæsthetics whenever the pain has any permanency. In *painful spasm* it is especially useful, as it seems very frequently to quiet the motor as well as the sensory disturbance.

2. "*To produce Sleep.*—Insomnia, occurring in acute disease and not dependent upon cerebral inflammation, may very frequently be relieved by the use of opium. In habitual sleeplessness its use requires caution, not only on account of disturbing digestion, but for fear of establishing the opium habit.

The adynamic delirium and sleeplessness of low fevers is best met by opium, but in most other cases chloral is the most generally applicable hypnotic. When pain coexists with wakefulness, the combination of opium and chloral is singularly efficient.

3. "*To allay Irritation.*—In many cases of disease, opium is serviceable by sustaining the system, as it blunts the sensibilities. In various local irritations it becomes of great value. By allaying irritation and pain, it is almost indispensable in many forms of inflammation, such as acute *peritonitis.*

4. "*To check Excessive Excretion.*—For this purpose opium is very largely used in diarrhœas, and is very efficient, either alone or in combination with various remedies. In *enteritis* and *dysentery* it is useful, more on account of its analgesic and antiphlogistic powers than from checking excretion. In *diabetes insipidus* the combination of opium and gallic acid is perhaps the most successful remedy. It is also useful, in conjunction with a restricted diet, in true saccharine *diabetes*, acting both as a palliative and as a curative remedy.

5. "*To support the System.*—Opium appears, in low fevers and in various adynamic illnesses, to afford actual support to the system, perhaps by allaying restlessness and tissue metamorphosis.

6. "*As a sudorific*, in the form of Dover's powders, it is largely used in febrile disease of an acute type, in the early stages of a "general cold," or other forms of muscular rheumatism. And recently it has been advocated as a sudorific and for the purpose of blunting the nervous centers in uræmia. Its use for this purpose, however, requires caution."

Cannabis Indica is a drug which possesses analgesic properties, but of more feeble and uncertain character than opium.

Action.—" When given in full doses, cannabis Indica produces a feeling of exhilaration, with a condition of reverie and a train of mental and nervous phenomena which varies much according to the temperament or idiosyncrasy of the subject, and very probably also, to some extent, according to the nature of his surroundings. The sensations are generally spoken of as very pleasurable; often beautiful visions float before the eyes, and a sense of ecstasy fills the whole being; sometimes the venereal appetite is excited; sometimes loud laughter, constant giggling, and other indications of mirth are present."

Uses.—As an analgesic, Indian hemp is very much inferior to opium, but may be tried when the latter for any reason is contra-indicated. In full doses, in *neuralgic* pains, it undoubtedly often affords relief. It has been largely employed to induce euthanasia in the advanced stages of phthisis. On account of its uncertain strength, the practitioner should try various samples until he procures an active one, and, being supplied with this, after learning its dose he should use this and no other. This drug has been highly extolled as an antispasmodic in traumatic tetanus and in other spasmodic diseases, as chorea and hysteria. Its power of exciting contraction of capillaries, and of restraining uterine hæmorrhage of a passive form, has been highly spoken of. The tincture is made by dissolving ʒ vj of the *extract of Indian hemp* in a pint of alcohol; forty drops of this is equal to about a grain of the extract.

Order II—Hypnotics.—For the purpose of inducing sleep, certain drugs are employed which do not necessarily assuage pain, and these may be termed hypnotics, or soporifics. "As an agent which depresses nervous action, chloral hydrate stands next to opium. There are differences, however, between the action of these two agents which are far from unimportant. It appears that, for the induction of sleep, two factors are requisite—cerebral anæmia, and a quiescent state of the cerebral cells. Opium acts more pronouncedly upon the cells than upon the circulation; while the effects of chloral are most markedly felt by the circulation, and to a less extent by the cells. Thus, in former times, a depressant, as tartar emetic, was combined with opium in conditions of sleeplessness due to vascular excitement. In such conditions chloral hydrate is the hypnotic *par excellence.* By its combination of qualities as a powerful vascular depressant and a sedative to the nervous system, chloral

is indicated in all cases of cerebral irritability with encephalic vascular activity, especially with a tense radial pulse. As an analgesic, chloral is far below opium, but in conditions of insomnia, due to arterial fullness, chloral is far superior to opium. When vascular excitement and pain coexist, these two agents should be given together. Another useful hypnotic is bromide of potassium. Its effect upon the cerebrum is very decided. It strongly tends to reduce cerebral excitement and to induce calm, refreshing sleep. In cases of cerebral excitement, as in the delirium of febrile affections, as in children where there is some vascular excitement also present, this agent may be combined with chloral hydrate. Such are the most notable and energetic members of a very important group of remedial agents." There are other members of this group possessed of similar properties in a less degree. For instance, we may employ hops, lactucarium, and other agents of more feeble properties, either alone or in combination with the more patent agents mentioned, as existing indications and the peculiarity of the case may suggest.

Order III—Mydriatics.—In this division of narcotics may be mentioned four medicines—belladonna, hyoscyamus, stramonium, and duboisin—whose preparations, when given internally or applied locally to the eye, dilate the pupil, or, in other words, produce mydriasis, while their action upon the general system appears almost identical. We shall, therefore, select for the general consideration of mydriatics the action and uses of belladonna.

The physiological action and therapeutic properties of belladonna depend on the presence of an alkaloid, termed *atropine.* This agent, or its alkaloid, applied locally, diminishes sensation, and can be absorbed through the unbroken skin. In small doses, belladonna is a cerebral exhilarant, tending to produce hallucinations and delirium, and sometimes sopor, but it is not a true hypnotic. This drug dilates the pupil in whatever way exhibited. In large doses the excitability of the motor and the sensibility of the sensory nerves are impaired by this drug, while the contractility of the striated muscles remains unaltered. On the motor-nerve centers it acts as a paralyzing agent. The drug increases the heart's movements by stimulating the cardiac ganglia of the sympathetic and paralyzing the peripheral ends of the pneumogastrics. An increase of the blood-pressure also takes place. The respiration is increased by stimulation of that center. Small doses increase the temperature, while large doses reduce it. It checks all the excretions, except, perhaps, that of the kidneys. This drug exercises a powerful influence as a physiological antidote against narcotism from opium, *these drugs acting in an opposite manner on respiration, brain, skin, pupil,* and *circulation;* and the administration of this substance by the stomach, or, still better, by the hypodermic injection of a solution of atropine, is one of the most available remedies that can be employed in opium-poisoning. For this purpose, from one sixteenth to one twenty-fourth of a grain of atropine will antagonize one grain of morphine.

Uses.—Belladonna is one of our most esteemed anodyne and antispasmodic remedies. It is destitute of hypnotic effect, and, on the contrary, has a tendency to excite wakefulness. In the treatment of neuralgia it ranks next to opium and hemp, and is extensively employed, both alone and in combination with quinine. Its powers of allaying spasm have been found very efficient in the treatment of whooping-cough and asthma. In lead colic, spasmodic constriction of the bowels generally, dysmenorrhœa, laryngismus stridulus, chorea, and tetanus, belladonna ranks among the best antispasmodic remedies. Applied locally, it relieves spasmodic stricture of the urethra and rigidity of the os uteri in labor. As a stimulant to the circulation, it is now thought useful whenever collapse is threatened from failure of the heart's action, especially in syncope from cardiac disease. By its influence in relieving irritability of the bladder, it is one of the best remedies for nocturnal incontinence of urine in children. Lately hypodermic injections of from 1-80th to 1-60th of a grain of atropine have been found useful in checking colliquative night-sweats, especially in phthisis. In myalgia and lur-

bagos the hypodermic use of atropine gives speedy relief, and may be advantageously combined with morphine.

The local use of atropine in diseases of the eye is of the greatest importance. Solutions of the alkaloid or its sulphate may be dropped into the conjunctival sac, to relieve pain and photophobia, to determine the refraction of the eye from its influence on accommodation in the diagnosis of suspected cataract, in operations for cataract, in iritis, prolapsus iridis, and ulcers of the cornea generally. Gelatine wafers containing 1-50th to 1-150th of a grain of atropine are sometimes used to dilate the pupil for ophthalmoscopic purposes.

Class II.—Anæsthetics.

The term anæsthetics, properly speaking, includes all agents which diminish sensibility and relieve pain. It has, however, been used to denominate a class of ethereal remedies which are applied by inhalation and produce such a condition of temporary insensibility as to prevent pain during surgical operations and parturition, and to relieve severe suffering from other causes when of transient duration.

Many substances have lately been introduced and used for this purpose, but the vapors usually employed to produce anæsthesia are those of *ether* and *chloroform*.

Action of Ether.—The first effects of the inhalation of ether are a sense of strangulation and cough from its local irritant action. When the vapor is absorbed into the system through the pulmonary surface, the nervous functions are successively and progressively affected. The mental faculties and volition become first impaired, insensibility and unconsciousness rapidly supervene, *during which susceptibility to pain is lost*, and the patient lies in a trance-like sleep resembling death. This condition is often preceded by one of excitement, during which some patients weep, others laugh, some shout, some pray or moan, sing, rave, or present pugnacious manifestations.

In the beginning of etherization the circulation is accelerated, but it is afterward depressed. The period of full ether narcosis lasts from five to ten minutes, and the patient ordinarily recovers without serious inconvenience, although headache, nausea, drowsiness, and languor sometimes ensue for a few hours. Occasionally congestion of the lungs, cataleptic rigidity with prolonged insensibility, and in females hysterical phenomena, ensue after etherization; but these effects are uncommon, and it is believed that death has never followed the use of ether when care has been taken to admit atmospheric air into the lungs along with the ether. During the stage of insensibility, convulsive twitchings or muscular rigidity are occasionally noticed; but these soon pass off, and the patient lies relaxed and quiet, with slow, regular automatic respiration. The occurrence of stertorous breathing, due to paresis of the muscles of the palate, shows that the stage of muscular paralysis is being reached. It should, except in very rare cases, be the signal for the immediate withdrawal of the anæsthetic. The face during etherization is reddish. Marked pallor and lividity are, respectively, important indications of failure of the heart's action, and failure of respiration. During the stage of insensibility the iris becomes fixed, the pupils are dilated, the eyeballs are upturned, and the orbicularis palpebrarum does not contract when touched. Insensibility to pain in some cases takes place before unconsciousness, and, when patients are recovering from the latter state, the mental faculties are often completely restored, while insensibility to pain continues. A brief period of anæsthesia, lasting less than a minute, has been noticed to occur before complete insensibility, which may be taken advantage of for short operations. When ether narcosis is fully established, the functions of the nerve-centers are involved in the following order: 1. The cerebrum; 2. The sensory centers of the cord; 3. The motor centers of the cord; 4. The sensory centers of the medulla oblongata; 5. And, lastly, the motor centers 'the medulla oblongata. The functions which continue to act are those siding over circulation and respiration.

"As an anæsthetic, ether does not act with the rapidity and pleasantness of chloroform, but it has the advantage of safety. So dangerous is chloroform, and so safe is ether, that there is no excuse for the use of the former agent under ordinary circumstances. The reason of the safety of ether is, that, unlike chloroform, it never suddenly paralyzes the heart. It may kill by producing asphyxia, but it does this so slowly, and, in the great majority of cases, after warning, which can be overlooked only through the most reckless carelessness. Many of the inconveniences which attend the use of ether can be obviated. Thus, in order to prevent the nausea which often follows the anæsthesia, the patient should avoid eating for at least six hours before the inhalation, and should take from one to two ounces of brandy just before commencing the latter process. Unlike that of chloroform, the vapor of ether should be administered in as concentrated a form as possible. When so inhaled in most persons, it will produce complete insensibility in from three to eight minutes." (Wood.) The quantity of ether necessary to effect etherization is about two ounces; and it may be conveniently applied by means of a cone of stiff paper, shaped so that its base will fit over the nose and mouth of the patient, and into which a napkin or small towel, or hollowed-out sponge, is placed; the sponge should be first soaked in warm water, squeezed dry, and saturated with pure ether. It is then applied to the mouth and nostrils, the mouth being permitted occasionally to receive atmospheric air; and, if irritability of the air-passages occur, this is to be gradually overcome. In this way from three to five minutes will ordinarily be required to produce anæsthesia, and its occurrence is known by the closure of the eyelids (if they have been previously open), failure to respond to questions, and muscular relaxation. The sponge is then removed, and may be re-applied from time to time if necessary.

Ether should not be exhibited where disease of the heart or brain or serious obstruction of the lungs exists, or when from any cause there is unusual tendency to syncope, and precaution should be taken to guard against asphyxia; but, when administered with proper care and discrimination, it is attended with little or no danger, or unpleasant results of any kind.

Action of Chloroform.—"As an anæsthetic, chloroform possesses the advantages of quickness and pleasantness of operation, smallness of dose, and cheapness. These advantages are, however, so out-balanced by the dangers which attend its use, that its employment under ordinary circumstances is unjustifiable. It kills, without warning, so suddenly that no foresight, or skill, or care can guard against the fatal result. It kills alike the robust, the weak, the well, and the diseased; even the previous safe passage through one or more inhalations is no guarantee against its lethal action." It ought, therefore, never to be employed except under especial circumstances, as when a speedy action is desired, as in *puerperal eclampsia*, and for the purpose of mitigating the pains of labor. In obstetric cases the excitement of child-birth seems to fortify the system against the deleterious influence of chloroform. So far as known, no fatal result has yet occurred from the use of chloroform in *parturition;* but the mortality from its use for other purposes is about one in three thousand administrations.

The *dose* for inhalation is a fluidrachm, to be repeated in two minutes if anæsthesia be not produced, and its effect may be renewed from time to time without injury. It may be applied on a handkerchief or towel folded into a bird's-nest shape and held near the nose or mouth, *care being taken to allow a proper admixture of atmospheric air.*

"A mixture of alcohol, chloroform, and of ether has been suggested as less likely to cause paralysis of the heart than the use of chloroform alone; but as the ether evaporates more readily than the chloroform, which may be left in excess, it must be difficult to modify these effects by combination, unless the mixture is freshly prepared and kept in a well-corked bottle. It is better to mix in small quantities at a time—one part of alcohol, two of chloroform, and three of ether. The word ACE fixes the proportions in one's memory." (Clover.)

On the slightest approach of symptoms of heart failure or asphyxia, the anæsthetic should be immediately withdrawn, the patient placed in a recumbent position, with the head downward, so as to favor the passage of arterialized blood to the brain; lessen the amount of the anæsthetic in the lungs by pressing the trunk with both hands and squeezing out as much air as possible. If, after this has been done for two or three times, the air does not readily re-enter the chest, the obstruction is to be overcome either by lifting the chin or drawing out the tongue. When death is threatened through asphyxia, the alternate dashings of hot and cold water upon the face and chest is often efficient. Artificial respiration should be commenced at once. Faradization of the diaphragm, by pressing one pole firmly against the stomach and placing the other over the larynx and root of the neck, often acts favorably.

The application of dry external heat-friction and passive motion, to aid in circulation, must not be forgotten, and efforts at resuscitation should be kept up for at least two hours.

Uses of Anæsthetics.—The objects gained by the administration of anæsthetics are various, according as we have to do with surgery, midwifery, or medicine.

In Surgery.—1. "A protracted and careful examination, and, consequently, more accurate diagnosis, can be made in cases of disease and injury where the intense pain caused by the examination prevents the manipulation of the surgeon—as in fractures, dislocations, and vesical calculi.

2. "From the total relaxation which the muscles receive under a full dose, the reduction of many forms of dislocation, hernia, etc., is facilitated.

3. "The general use of many forms of remedial operations is extended which otherwise are attended with such exquisite agony that they were rarely resorted to unless from most extreme necessity, as, for example, the application of the actual cautery and moxas.

4. "Many operations can now be performed for the relief of long-continued disease or after injury which before would have been hazardous, owing to the depressed or feeble state of the patient.

5. "Many delicate operations can now be easily performed where perfect quiet is demanded of the patient, and which can hardly be afforded by any amount of exercise of the will, as in operations upon the eye, dissection of nerves, or the taking up of arteries.

6. "Patients will now apply earlier than heretofore for relief in surgical diseases, the dread of the surgeon's knife often having induced them to postpone it until the case became almost hopeless.

7. "The mortality from operations has materially decreased, for it is well known that pain has a serious tendency to depress the nervous system, and to produce death from exhaustion or shock."

In Midwifery.—1. "In addition to preserving the mother from pain, always incident to parturition, we have the power of preserving her strength unimpaired when the labor is long-continued or especially severe.

2. "In all cases of instrumental labor, or those requiring manual assistance, the aid can be afforded with greater ease to the accoucheur, and more safety and less suffering to the mother.

3. "Many cases of doubt in diagnosis can be more correctly solved.

4. "From the relaxation of the muscular fibers, the exit of the child through the uterine neck or the vaginal passage, when they are rigid, is facilitated.

5. "Anæsthetics have the power of keeping in abeyance and reducing the violence of one of the worst complications of labor—puerperal convulsions.

6. "The recovery of the patient after labor is assisted, and the chances of subsequent danger lessened."

In Medicine.—1. "Anæsthetics have been resorted to in a variety of morbid conditions in which the administration of narcotics and antispasmodics ..s been found useful, as they exert a powerful control over the violent ...s of spasmodic disease, and may be used with the greatest advantage in ...eria, tetanus, poisoning from strychnine, asthma, chorea, convulsions,

whooping-cough, dysmenorrhœa, the passage of calculi, neuralgia, and severe and exhausting pain of some forms of disease.

2. "They may be used as a narcotic in mania, delirium tremens, etc.

3. "They are found useful in the detection of feigned diseases, as affecting paralysis, dumbness, or contraction of limbs, and for other diagnostic purposes."

Subjects for Anæsthetics.—In conclusion, we may say generally that any person fit for a severe operation is a fit subject for an anæsthetic; but no one is so free from danger that care in watching its effects can be dispensed with. The cases requiring the greatest vigilance are not the young and delicate, for whom a small dose suffices, but the strong and vigorous, who inhale deeply and struggle much. Ether is probably better for those suspected of fatty degeneration of the heart, although many such cases are entirely satisfactory under chloroform. Many of the deaths under chloroform have occurred in intemperate drinkers, and the presence of alcohol in the system undoubtedly intensifies its effects. Patients should not take an anæsthetic until after fasting a few hours. The horizontal position should be selected, if possible, and the dress should be loose, so as to present no impediment to respiration. When the administration is begun, the patient should be instructed to breathe regularly and freely. Most patients are at first afraid of breathing, and some hold their breath for half a minute. With others the vapor excites swallowing or coughing. In these cases its strength may be diminished by withdrawing the anæsthetic slightly from the mouth until tolerance is established; then deep and regular breathing may be encouraged. After volition is abolished, any pause in the breathing should be noted, and more or less fresh air given. Safety and prudence in all cases demand that the respiration and pulse be closely and carefully watched by a skilled and competent observer, and especially is this important when the anæsthesia is protracted during severe surgical operations.

Class III.—Antispasmodics.

By this term is meant those medicines which prevent or allay spasm.

Action.—Certain nerves and nerve-centers, when excited, produce contraction of voluntary or involuntary muscular fibers. Other nerves and centers arrest movements; and, by the combined action of these two systems, the motions of the various contractile structures in the body are regulated, and subordinated to the normal requirements of the organism. Excessive contraction or spasm of one part of the body may, therefore, arise either from excessive action of the *motor* or deficient action of the *inhibitory* centers. Spasm may affect the involuntary muscular fibers of the intestines, as in colic; of the vessels, as in some forms of headache, and in vaso-motor neuroses of the uterus and bladder; single voluntary muscles or groups of muscles, as in various forms of cramp; or the muscular system generally, as in tetanus, chorea, epilepsy, or hysteria. In this way spasm may be due to special local irritation; colic may arise from improper food, asthma from certain states of the atmosphere, or the spasm may arise from organic disease of the nervous centers, as in inflammation of the brain or spinal cord, or of their membranes from tumors and hæmorrhages, or from poisoning of the centers by abnormal constituents of the blood, as in Bright's disease; or the nervous centers, especially the spinal cord and the medulla oblongata, may become too sensitive, as in tetanus or lock-jaw, poisoning by strychnine, and in epilepsy.

Antispasmodics may act by stimulating those portions of the nervous system which restrain and co-ordinate movements, as well as those which control those impulses which originate in the cerebral centers themselves, and which are connected with the emotions. "As a result of this state, various symptoms arise of trifling import, but often apparently severe and always annoying. Such symptoms, in their mildest form, constitute the state of known as *nervousness;* in their severe type they may rise in intensi

the wildest convulsions of *hysteria*." In this class of affections certain drugs are useful. As the condition which they relieve is often associated with weakness, they are often spoken of as "*nervous stimulants*," and include such agents as valerian, asafœtida, and compound spirits of ether. Such agents stimulate the nervous system generally; and as spasm often occurs when the nervous system is deficient in power, nervine and general tonics, such as quinine, zinc, and iron, are often found to be useful adjuvants.

Again, there are certain drugs which appear to *act by lessening the irritability of the motor centers*, and include depressing agents, such as bromide of potassium, opium, tincture of veratrum viride, antimony, and other nauseants, and these may often become our most efficient antispasmodics.

Uses.—In such convulsive diseases as epilepsy, laryngismus stridulus, and infantile convulsions, bromide of potassium, belladonna, and chloral hydrate are the most powerful antispasmodics. Opium often relieves spasm attended by pain. Ether and chloroform exert the same influence, and are the most powerful antispasmodics in any form of spasmodic disease; but, unfortunately, their effects are but temporary. In chorea—arsenic, zinc, and calabar-bean have been successfully employed; the latter agent is also used in tetanus. In spasmodic asthma—lobelia and nauseating agents are useful. In hysteria—valerian, asafœtida, and other nervous stimulants may be tried; while in some cases opium and nauseating drugs prove most useful during the attack, and other agents, such as iron, zinc, and arsenic, which may act as tonics, may be employed as preventive measures. In organic disease of the brain and spinal cord, the disease, instead of the symptoms, should receive attention. The medicines classed under the head of antispasmodics are of small importance in comparison with correct diagnosis and appropriate modes of treatment, having for its object the removal of the cause in each special form of spasmodic affection. In almost all spasmodic affections the medicinal treatment is greatly aided by the judicious enforcement of hygienic measures; and late hours, a close atmosphere, exhausting emotions, or excessive bodily or mental work, should be avoided.

Class IV.—Antipyretics.

We here use the term antipyretic to designate those medicinal agents that are employed to reduce excessive degrees of body-heat.

Action.—"For the purpose of lowering the body-temperature, various means have been resorted to from time to time, according to the state of our knowledge, the fashion of the day, and the progress of physiology."

It is obvious, says Fothergill, that an increase of heat-production must depend upon one of two things: (1) An imperfect heat-loss, (2) and an increase in heat-production; in some cases the two are combined. "Some remedies act so as to increase the bulk of the blood in the heat-losing area, and to set up perspiration with its cooling effects, while other remedies act by diminishing heat-production. It is evident that increased action of the skin exercises a most distinct effect upon heat-loss. Consequently, agents termed diaphoretics have been rationally and logically resorted to in the treatment of fever. Experience, however, has taught what physiology now explains, that the diaphoretics to be selected for the purpose of lowering the temperature are those exercising a depressing action; that is, they not only act upon the cutaneous vessels, but they at the same time depress the circulation. They are the nauseant diaphoretics, of which antimony and ipecacuanha are the best-known examples. These agents not only dilate the cutaneous vessels and act upon the sudoriparous glands, but they also depress the action of the heart, and so retard the circulation, and with it lessen the chemical interchanges." The best effects from antimony are obtained by giving small and often-repeated doses, so as to produce a steady effect, and its action is greatly -isted by small doses of opium, which acts upon the nervous centers in-ly to the fever poison. Aconite is also a useful agent in lowering the in force and rapidity, as well as increasing the action of the skin.

Given in the earlier stages of acute and inflammatory fevers, the skin, dry, hot, and burning, becomes in a few hours comfortably moist, and in a little time longer bathed in a profuse perspiration. It is best administered in drop-doses of the tincture in a teaspoonful of water, every half hour or hour, if there be much prostration. Tincture of veratrum viride is also used as a depressant to the circulation, and to increase the action of the skin. It should be given in small doses at short intervals, two or three drops every hour or two hours, and corresponding doses of laudanum (five to ten drops) may be given with each dose. The addition of opium will serve several good ends, especially in its action upon the nervous system and in its effects upon the skin.

It sometimes happens that the remittent form of malarial fever is marked by an extraordinary degree of high temperature: a rapid and bounding pulse, the skin being dry and hot, the patient is racked with aches and pains and is extremely restless, so that it is desirable to bring about as early a reduction of temperature and amelioration of symptoms as possible. In such cases the administration of a single large dose of tincture of veratrum viride (ten or twelve drops), followed by a hypodermic injection of morphine (grain, one fourth), secures prompt reduction of the fever by profuse sweating, as well as ease and comfort to the patient.

In regard to opium in the treatment of high temperature, it should be remembered that it always acts best in combination with a sedative. Given alone, its use is unsatisfactory, since high temperatures excite the brain, and the first effects of this drug add to the existing excitement. For this reason the combination of opium with antimony constituted one of the most efficient antipyretic measures in times past, and is no less efficient to-day; each drug appears to assist the action of the other, and the relative doses must be determined by the circumstances of the case. "In furious delirium the tartar emetic must be given in full and the opium in small quantities, while, if wakefulness is the chief symptom without much delirium, the dose of antimony must be reduced and the opium increased." In sthenic fever, wine of antimony, tinct. opii, and liquor ammon. acetatis is an excellent combination. Or the following mixture will be found both palatable and efficient: ℞ Antimonii et pot. tart., gr. ij; morphinæ sulph., gr. j; sodæ et pot. tart., ℥j; aquæ, ℥iv; syrup simp., q. s., ad. ℥vj. M. S. Tablespoonful every two or three hours.

Another efficient antipyretic belonging to this group is gelsemium, which may be given in the prescribed doses of the tincture (five to ten drops) every two or three hours until its physiological action is obtained; it excites very free diaphoresis.

Another powerful remedy in controlling temperature in febrile conditions is chloral hydrate; but it must be given in full doses, and seems especially indicated in those cases in which the combination of opium and antimony has been suggested. It may be given alone, or, if there be also acute pain, as in rheumatic fever, it may be combined with opium. This combination suggests itself whenever there is severe suffering. It should be given in flavored syrup. In addition to the remedies mentioned, there are other measures which are useful in pyrexia for dissipating heat, such as saline purgatives, the mineral and vegetable acids, sponging the surface with tepid water, or the abstraction of heat by the graduated cold bath or wet pack, the chief use of which is to excite diaphoresis.

Such, then, are the different measures to be resorted to in pyrexia associated with heat-accumulation from defective heat-loss; and their use is suggested when pyretic conditions are found with a dry, burning skin, and arrest of the action of the sudoriparous glands.

When, however, there is pyrexia with an already moist, perspirable skin, other measures are indicated. For in such cases as these there is no defect in heat-loss, and we are required to resort to those antipyretic agents which appear to strike directly at heat-production. Such agents we possess in quinine, salicylic acid, and digitalis. Quinine, in doses of ten grains, given at

short intervals until twenty to forty grains are taken, has a decided effect in lowering the temperature in typhoid fever, and in other affections characterized by great elevation of body-heat. It is supposed to exert this power by checking the ozonizing power of the blood—by preventing the due giving up of oxygen by the red-blood corpuscles. Salicylic acid may act in a similar way—that is, by lessening oxidation. Digitalis appears to antagonize the febrile movement.

In pyretic conditions, when the skin is moist, digitalis and quinine may be profitably combined. The antipyretic action of quinine appears to be increased, while some of its unpleasant effects are diminished, by the addition of opium.

Among other measures which diminish heat-production may be mentioned venesection; but bleeding is now almost obsolete as a general practice, chiefly in consequence of its abuse. It is, however, an effective measure for lowering temperature, and might still be resorted to with plethoric patients in sthenic disease when it is desirable to produce an impression quickly and decidedly upon a rising temperature. If employed, it should be confined to making an initial impression, and its effects followed up by the administration of depressant antipyretics, to prevent an after-rise of temperature from reaction. "Where its use was followed by salines, or the old 'fever mixtures,' the effects of venesection were far from undesirable." (Fothergill.)

The whole subject of body-heat—its production, its dispersion, and its disturbances—call for more general attention than it has yet succeeded in attracting. The *rationale* of hyperpyrexic temperatures should be more carefully studied. More thought should be given to the how, the why, and the wherefore of the pyrexia, and, consequently, of the best means of reducing it. The physician in these cases should do something more than note the register of the clinical thermometer: he should carefully examine the condition of the skin and excretions generally, and thus endeavor to ascertain the amount of heat-dispersion; to estimate, if possible, which is the most potent factor in the febrile condition—diminished heat-loss or increased heat-production—and thus determine the indications for those antipyretic measures best adapted to the exigencies of each case.

Uses.—Antipyretics act much more powerfully in reducing the temperature of the body in fever than they do in health. They may be used whenever the temperature has risen, either from exposure to high external temperature, as in thermal fever; in consequence of inflammation, as in pneumonia or pericarditis; or as a result of septicæmia, as in erysipelas; or as the result of essential and specific fevers, as acute rheumatism, scarlatina, etc. The most rapid and powerful antipyretics are the cold baths; next, probably, come large doses of quinine and salicylic acid. These being the most potent agencies, we shall conclude this article with a brief consideration of those diseases and morbid conditions in which their employment seems most applicable. The antipyretic properties of quinine are much prized in Germany, and it is there largely used in the treatment of typhus and typhoid fever, acute rheumatism, and pneumonia. Immense doses, even reaching 75 grains, have been given; and it is observed that tolerance of the drug is undoubtedly present in fever, and that very much larger doses can be taken than in a state of health. It is only when very freely given, however, that it has any cooling influence, and we are advised to prescribe from 25 to 45 grains in divided doses within the first half-hour, and then allow an intermission of from 24 to 48 hours. (It is best given about six hours before the morning remission.) This method is considered best, as its effects would be diminished by spreading it over a longer time, on account of its rapid elimination. Notwithstanding the flattering statistics of Liebermeister, the profession in other parts of the world are not much inclined to this extensive use of quinine in febrile disorders, particularly in typhoid fever. Even some of the ghest authorities of Germany have abandoned its use. Professor Gairdner, Edinburgh, is opposed to its use, and has characterized the German plan as

a battledore-and-shuttlecock treatment, consisting, as it does, in keeping the patient, partly by means of cold baths and partly by these other remedies, in a condition of constant oscillation between the state of reaction and the verge of collapse. In this country many eminent authorities are skeptical as to the propriety of giving toxic doses of quinine in typhoid fever. In reference to this subject Professor Bartholow is very explicit. He says that a careful examination of the large number of facts which have been accumulated, and considerable personal experience and observation, have satisfied him of the inutility of quinine in the treatment of enteric fever. Not only has this remedy no influence over the course and duration of this disease, but its irritant effects upon the gastro-intestinal mucous membrane, and the inhibitive influence exerted through the organic nervous system upon the heart, render it positively injurious in large doses. As a rule, he says, the dryness of the tongue, the diarrhœa, the subsultus, and the delirium are increased by its use. According to Professor H. C. Wood, the excretion of urea is diminished. Similar views are likewise entertained by Da Costa, Stillé, and other eminent teachers of clinical medicine in this country. Professor Flint, however, favors the use of antipyretic doses of this agent, but makes it subordinate to cold baths, and admits that it may fail entirely as an antipyretic in a certain proportion of cases. Our own experience is opposed to its indiscriminate use in this disease. That there is a certain degree of temperature in typhoid fever incompatible with life, no one disputes, especially if long continued. That quinine exerts a temporary control over this abnormal heat in the majority of cases is equally established. But the question arises, Is quinine the most desirable or suitable remedy for reducing this excessive heat? Does the mere temporary reduction of high temperature banish all the dangers of the disease in question? Do not cases occur in our practice of moderately high and long-continued temperature which often recover, while others characterized by a moderately low temperature sometimes die? Are there not other factors besides excessive heat which play an important rôle in the mortality of this disease? Do not our patients sometimes die from *uræmia*, and is it not well established that large doses diminish the excretion of the poison (Wood says 25 grains, 40 per cent)? Is there less danger from the toxic action of quinine in producing paralysis of the heart than that which proceeds from its rapid action? If so, why does not this event occur from the same influence in exophthalmic goitre? Is not the mortality as often due to intestinal hæmorrhage and perforation as the hyperpyrexia? In view of these queries, we hold that this remedy in this particular disease should not be given without great discrimination and judgment. It should certainly never be given in typhoid fever simply because the patient has typhoid fever. But in those cases in which the temperature is 104° or 105° F., or even less, and long continued, and cold baths are inadmissible, and other measures fail to abate the excessive heat, then resort may be had to this agent, *though it will certainly increase the duration of the disease.*

The antipyretic effects of quinine are most conspicuously shown in those diseases which are of a malarial character, but in all other forms of continued fever the resultant diminution of temperature is but temporary, and has no influence on the progress of the disease. As an antipyretic, this agent is also used in scarlet fever, severe erysipelas, in lobar pneumonia of children, and, in short, wherever there is a serious elevation of temperature, except it be in inflammation of the brain and its membranes. In septic diseases, quinine has very important uses, and is freely employed in septicæmia, pyæmia, erysipelas, and puerperal fever. In traumatic or surgical fever, Professor Billroth states that, of all remedies, it is the most efficient, but should be given in combination with opium. In conclusion, it is but fair to state that, whatever objections may be made to the use of quinine as an antipyretic on other grounds, it has the merit of scientific precision. In hyperpyrexic conditions it affords us a powerful remedy in bringing about definite results—that is, reduction of excessive temperature and the possible prevention of changes in parenchymatous structure and dangerous sequelæ—results whicl

if due to this cause, are not so conveniently nor always so certainly obviated by other remedies.

Another powerful antipyretic, especially useful in acute rheumatism, is salicylic acid; but, as this agent is irritating and very insoluble, it has been almost entirely displaced by the salicylate of soda, which is freely miscible with water or syrup, and is readily absorbed, the dose being gr. xx to ʒ j, being generally administered in the smaller dose every hour until a drachm has been given daily. In an ordinary case of acute articular rheumatism we may count upon cutting short the disease in two or three days, the pain subsiding first and then the fever. For the reduction of temperature, digitalis is seldom used in this country; but in Germany its antipyretic virtues are better appreciated. It seems to antagonize the febrile movement without influencing the course of the disease. It is slow in its action, and must be given in large doses, which may derange the digestive functions, even if they do not prove directly dangerous; for these reasons there does not seem to be much real benefit following its employment. Fothergill suggests its combination with quinine and the mineral acids, in the treatment of hyperpyrexic conditions, when the skin is moist. The following form of administration is recommended: ℞ Quininæ sulphas, gr. v; tinct. digitalis, ♏ xv; acid phosph., dil., ♏ xv; aquæ, ℥ j. M. S. This amount every four hours. Such a combination might be indicated when the typhoid condition is established, and should be used in connection with alcoholic stimulants, milk, and other nutrient fluids. When this condition is pronounced, the depressant antipyretics are distinctly contra-indicated. The chief hope then lies in the natural powers of the constitution, and in such cases recovery becomes mainly a question of stamina.

Class V.—Antiperiodics.

The term antiperiodics is employed to designate those medicines which prevent or relieve the paroxysms of certain diseases which exhibit a periodic character.

Action.—The mode of action of antiperiodics is at present unknown, but observation teaches that there is a general law of periodicity which regulates all the vital movements. If we inquire into the causes of these periodical changes, we find reason to believe that they are in part dependent upon cyclical processes inherent in the system, and partly upon periodic agencies acting from without, or that resulting from a combination of the two. With regard to the external agencies, it is to be noticed how closely the periodical changes connected with the vital movements are linked to the periodic phenomena observed in nature at large. Thus, digestion and fasting, wakefulness and sleep, correspond with day and night, light and darkness, and its accompanying changes of temperature. It is known that vital activity is at its lowest between the hours of 1 and 3 A. M. After 3 A. M. the activity increases, at first slowly, and then more quickly, until a maximum is reached between the hours of noon and 2 P. M. A progressive decline follows, rapid at first, slower as the evening draws on and falls into night, until the minimum is again reached between 1 and 3 A. M. These influences, of a periodical character in health, continue to exert their impression in morbid states of the system by intensifying disease at certain times and lessening its effects at others, either as the activity of the vital forces may be greater, or their excitability diminished. Most, if not all, paroxysmal attacks of disease are probably due to the gradual accumulation of contaminating material in the blood from deficient excretion. This, in malarial affections, within a certain length of time, will begin to exert a toxic influence upon the nerve-centers, ordinarily producing rigor, fever, and sweating, or culminating in some other eliminative action, and these morbid phenomena will be repeated at certain definite intervals corresponding with the rate of reaccumulation of the blood-poison, and partly with the state of excitability of the nervous system. ᵃsoning from this standpoint, it is fair to assume that medicinal agents r act as antiperiodics in one of three ways: 1. By increasing the activity

of the excretory functions, as by the use of emetics, cathartics, or diaphoretics; 2. By blunting the excitability of the nervous centers, by the use of narcotics given before the expected paroxysms; and, 3. By bracing up the nervous system during the intervals of the paroxysms, by the use of quinine, arsenic, and other neurotics, until nature, assisted by other means, can have time to eliminate the *materies morbi*, or else to enable the system to become tolerant to the toxic element in the blood, which exerts a causative influence. The latter class of agents are not specifics, not chemical antidotes to malarial infection, but their action is due to a physiological antagonism.

Uses.—The most important use of quinine and its salts is in the cure of malarial diseases. The antiperiodic property of quinine is increased and the cerebral effects of large doses are diminished by combination with morphine.

It is well known that intermittents arrested by quinine or other antiperiodics manifest a tendency to recur about the septenary periods (or every seventh day from last paroxysm). It is best, therefore, that ten or fifteen grains of quinine should be administered, in anticipation of these recurrent attacks, until the third septenary period is passed. The action of quinine is much assisted by the continuous administration of arsenic about three times a day; and, in the mean time, due attention should be given to the excretory functions. In the treatment of intermittent or remittent fever, two modes of using quinine are employed. First, the remedy is withheld until after the administration of emetics and purgatives, or, in remittent fever, until, by diaphoretics and baths, a distinct remission is produced. The second plan is to give immediately from ten to twenty grains, or even more, once or twice each day. In remittent fever, the antipyretic effects of large doses is relied upon to bring down the temperature. In our own experience, we think, if the treatment is preceded by the use of emetics and cathartics, that often the duration of the fever can be much abridged and controlled with much less quinine, and that the first, or the old plan, though less fashionable, is more efficient.

In certain parts of the United States the so-called pernicious fever prevails, and all authorities agree that no time should be lost in the prompt use of large doses of quinine, administered by the stomach, rectum, or subcutaneously. The so-called typho-malarial fever usually requires large doses of quinine, but they are generally regarded as less and less effective as the typhoid element predominates. Should true remissions recur, and not merely the rhythmical morning remissions and evening exacerbations characteristic of enteric fever, quinine is indicated, and is most efficient when given in an occasional large dose during the remission. Quininæ sulphas is of great value in all neuralgias of malarial origin showing a well-marked periodicity. It is also useful in a certain proportion of non-malarial cases. Certain neuralgias may occur as an expression of malarial infection, being substituted for the ordinary chill, fever, and sweat, or they may assume the orderly periodical character in consequence of having occurred in a system under the influence of the malarial cachexia. Malarial neuralgias require large doses of quinine, from ten to twenty grains, according to the severity of the attacks and the obstinacy with which they recur, and the paroxysms should be anticipated by the exhibition of the remedy from three to five hours before the expected attack. In these cases the curative effect of the quinine may be enhanced by combination with morphine. It may be combined (as in the form of Gross's neuralgia pill) also with strychnine, arsenic, and aconite. Sometimes diarrhœa and dysentery occur in the periodical form, due to the immediate influence of malarial infection, and under such circumstances quinine affords relief.

Periodical attacks of laryngismus stridulus, false croup, and many neurosal affections, may be prevented by the use of quinine during the intervals of the attacks. The other alkaloids of cinchona have a similar action to that of quinine, but they are not so powerful. Beberine is about one third as powerful, and is by no means so certain; the same remark applies to eucalyptus and salicin. In some cases of ague and other periodical affections. arsenic proves successful when quinine fails. Emetics and purgatives ai

useful auxiliaries to quinine in the treatment of ague, and are employed alone for the cure of this disease in some parts of the world where quinine is not available. In chronic ague the following is suggested by Bartholow as an effective combination: ℞ Quininæ sulph., chinioidini, hydrastinæ, each, ʒ j; res. podophylli, gr. v; ferri sulph. exsic., ʒ ss. M. Ft. pil. No. 40. S. Two pills three times a day.

Class VI.—Tonics.

Tonics may be defined as therapeutic agents which impart permanent strength to the body.

Action.—According to H. C. Wood, such agents, when taken internally, act upon the nutrition of the various tissues so as to restore lost tone, not by calling into play the vital principle of contractility, but by increasing the power in the part. They differ from astringents in that they affect nutrition, and, consequently, in the slowness and permanence of their action. They differ in a similar manner from simple stimulants, and, as they do not call into sudden action forces already existing in the part, but increase power by increasing nutrition, their influence is a permanent one, and is not followed by depression.

Uses.—"In administering tonics, care should be always taken to ascertain that the case is suitable, for in very many cases of apparent debility the imperfect functional activity of the body or of its parts does not depend upon insufficient nutrition, but upon imperfect removal of the products of 'waste.' The proper treatment in these cases is not to give tonics, but to remove the waste products by cholagogues, purgatives, and diuretics."

Tonics are, of course, indicated by debility dependent upon impaired nutrition—that is, debility owing to actual loss of power. When the debility is due to a sudden depressing influence, as in snake-bite, they are of no service whatever. They are especially valuable in convalescence from acute disease; during the progress of the disorder they often do more harm than good, on account of the presence of unremoved products of tissue waste. Tonics should, of course, never be used when plethora exists. Sthenic inflammatory action is also a contra-indication to their employment; but, when inflammation exists with a general state of debility, these drugs may form an essential part of the treatment.

The tonics are divisible into several sub-classes, which may be considered under the head of simple bitters, aromatic bitters, and mineral tonics. Probably all bitter vegetable substances possess tonic properties, but in many of them, as in morphine and strychnine, these properties are completely overshadowed by other inherent powers. "There are, however, bitter vegetable substances which so act upon the stomach as to invigorate digestion and to affect thereby the general nutrition without exerting any direct influence upon other portions of the body than the alimentary canal. These are the simple bitters. In overdoses they nauseate, and may act slightly on the bowels. They all appear to act alike—differing more in strength than in quality—so that one may be substituted without detriment for another. As they are essentially irritants, inflammation or over-sensitiveness of the alimentary mucous membrane distinctly contra-indicates their administration. They are indicated by loss of appetite and loss of stomach tone." The most active and efficient of the simple bitters are quassia, gentian, and calumba. There are certain remedies, usually spoken of in treatises on materia medica under the general head of tonics, which might properly be considered local stimulants, acting, as employed in medicine, upon the alimentary canal. These are the so-called aromatic substances, dependent for their virtues upon the presence of a volatile oil; but some of the tonic drugs containing a volatile oil also have in them a bitter principle, which modifies their action. Such drugs are known as *aromatic bitters.* As bitters they are less powerful than such drugs as quassia, and are especially indicated where the stomach s delicate and easily nauseated. The chief contra-indication to the use of romatics is inflammation of the stomach and bowels. Unlike simple bitters,

they are often useful in *diarrhœa* of nervous irritability, or of relaxation, when no decided inflammation exists. The most useful of the aromatic bitters are chamomile, serpentaria, and eucalyptus.

The mineral tonics include the mineral acids and the astringent salts of iron, zinc, and copper. The mineral acids are the only tonics which should be given during acute disease. During convalescence they may be very suitably combined with vegetable bitters. Iron is not only a good blood tonic, but its more astringent salts promote the appetite and digestion; they may for the latter purpose be combined with the simple bitters. The salts of zinc and copper appear to exert their greatest tonic influence upon the nervous system. Arsenic may also be used for the latter purpose, and the action of such agents may be greatly assisted by combination with nux vomica and strychnine. As the different preparations of iron are heating to the system by increasing oxidation, they may generally be given in connection with purgatives. Ferri sulphas and tr. ferri chloridi are considered the best general tonics of this division.

Class VII.—Stimulants.

The term stimulant may be defined as anything which increases the natural function of a part. Under the present heading, however, we shall only consider those which exert an invigorating influence upon the heart and vascular system.

The term cardiac stimulants may be used to designate a number of medicines which, when given internally, increase the power and force of the circulation, and are used by the physician for such purposes. There are some substances that are heart stimulants in reality, but which possess other properties in so great a degree as to overshadow their cardiac relations, and are not used by the physician to affect the circulation; such medicines are considered in connection with those powers which give them their chief clinical value, and are not included in the present class. The chief cardiac stimulants are ammonia, alcohol, and digitalis.

Uses.—Ammonia is chiefly indicated in sudden failure of the heart's action. "The more sudden and purely functional this is, the more efficacious is the remedy. When the failure of the circulation depends upon a slow and persistent cause, as in *adynamic fevers*, ammonia is not generally useful, but may be employed as an adjuvant to alcohol in the crisis of the disorder." In poisoning by venomous serpents, ammonia has been largely used; though certainly it is in no sense a chemical antidote, but acts by antagonizing the sedative effects of the poison upon the circulatory system. In failure of the heart's action during *anæsthesia*, in *poisoning* other than from snake-bite, and in cases of *sudden collapse* in disease, as is sometimes seen in the *exanthemata*, in *cholera*, in *pernicious malarial fever*, or after *surgical operations* or *injuries*—ammonia may be administered by the stomach, by inhalation, and, in urgent cases, by hypodermic injections. From fifteen to twenty-five minims of the stronger water of ammonia, diluted with four times its bulk of water, may, in desperate cases, be thrown directly into a vein of the arm, and repeated in fifteen minutes if necessary. The ammonii carbonas is the best preparation for continuous use in *typhoid pneumonia*. It should be given in emulsion, in doses of five to ten grains, repeated as required. The aromatic spirit of ammonia, a convenient and elegant preparation, may be given in connection with alcoholic stimulants, or simply diluted in syrup or water. As a general thing, the aromatic spirit of ammonia in teaspoonful doses is the best suited for internal use.

"Our knowledge of the physiological properties of alcohol shows that its chief therapeutic value in acute disease is, as a stimulant, a temporary imparter of power which will enable the system to stand some strain of like duration—to bridge over some period of weakness." (Wood.) Whatever views we may hold regarding the propriety of recommending stimulants of this kind to persons in full health, the urgent necessity for their administrati-

certain diseased conditions is one of the fundamental principles of medicine. It is true, in some cases, that we may be enabled to treat successfully acute disease without alcohol; yet it is no less an acknowledged fact that, under well-recognized conditions, we are bound to give it to our patients with no sparing hand. When the tongue is becoming dry and brown; when the pulse is weak, soft, rapid, and irregular; when the first sound of the heart is low and muffled; and when muttering delirium is setting in—then we know that the time for wine or spirit has arrived, and that, under its judicious use, the tongue will moisten, the pulse become slower and firmer, and the sufferer may sink into refreshing sleep. Good whisky, or brandy, or the effervescing wines are best suited for these emergencies, and must be given at regular intervals and in carefully measured doses, according as the progress of the disease and the condition of the patient seem to render their administration necessary.

The cases to which alcohol is especially adapted may be divided into three classes:

1. "Those in which there is a temporary loss of heart-power, as in fainting from exhaustion or other cause. In these cases the alcoholic stimulant should be given, if possible, hot, and not much diluted. With it should also be exhibited some more rapidly acting, diffusible stimulant, such as ammonia.

2. "Those acute diseases in which the powers of the system are in danger of being used up: to aid the digestion of food and in the maintenance of power. One great source of its value in these diseases is the power it imparts of assimilating food, and in milk-punch are furnished the stimulant to digestion and the most perfect food known for digestion. Employed for this purpose, it is useful in *all* stages of the *adynamic fevers*, such as *typhus* and *typhoid*. This use of alcohol is apart from its office, in the lowest stage of fever, as a heart and nerve stimulant. By the exhibition of three or four ounces of milk every two hours with one or two drachms of brandy or whisky from the beginning of the attack, in many cases the development of the severe adynamic symptom may be prevented. But in the advanced stages of disease, when the *typhoid state* is well developed, alcohol should be given boldly—to quiet by stimulation the nervous and circulatory systems—to afford a food which shall, in a measure, replace the natural pabulum—to aid in the digestion of milk and other simple nourishment—to aid in lowering the temperature by checking the tissue waste of fever—in a word, to enable the system to stand the drain upon its vital powers, and at the same time to check such drain. The guide to the amount used should be the effects produced. So long as it lowers temperature and pulse-rate, moistens the dry tongue and skin, and quiets the nervous disturbance, it does good. If, however, the tongue grows drier, the pulse puts on an angry, bounding character, and the patient becomes restless and uneasy, stimulation is being pushed too far, and the amount given should be lessened. True arterial excitement and sthenic inflammation contra-indicate its use. In itself, high temperature is never a contra-indication to alcohol, and, should this be associated with adynamic symptoms, it may prove a useful antipyretic. In *acute sthenic disease*, after the progressive stage has passed and the results of the disease simply remain to be overcome, alcohol and milk will often save life. Thus, in *acute pneumonia*, when so much consolidation has occurred as to render it doubtful whether the exuded material can be removed, or in abscess, when large amounts of pus have formed, the demand may be very great for alcohol as a food and as an aider of digestion, and sometimes as a stimulant.

3. "Alcoholic stimulants are often demanded in those cases in which the system is laboring under a depressing agent. In many forms of poisoning, to antagonize such influence, they may be used with signal advantage simply as arterial and nervous stimulants. Thus, in snake-bite, the unlimited use of [illegible]se, with the hypodermic use of ammonia, affords the best treatment. [illegible]y are useful in *pyæmia*. In poisoning by *aconite*, *veratrum viride*, or [illegible]r similar substances, where death is threatened through failure of the

heart-power, alcohol, in some form, is imperatively demanded, and should be administered freely, and but little diluted."

When a mild stimulant is wanted in the beginning of fevers, especially if milk-punch seems too "heavy," *wine whey* may be sometimes used with advantage. It is made by pouring a half-pint of sherry into a pint of boiling milk, stirring thoroughly, and, after coagulation has occurred, straining off the whey, which may or may not be sweetened, according to the taste of the patient. *Mulled* wine is often very grateful to patients as a change. It is made by beating up an egg thoroughly with three fluidounces of sherry, and adding a like quantity of water, which must be actually boiling when poured in.

Champagne is useful in patients with delicate stomachs, especially if nausea or actual vomiting exists, and also may be employed with advantage in sudden failure of the vital powers in elderly persons.

Milk-punch is prepared by adding from one to two tablespoonfuls of brandy, whisky, or rum, according to the degree of stimulation required and the taste of the patient, to three fluidounces of milk, with sugar and nutmeg to taste. The addition of a tablespoonful of lime-water is not recognized by the taste, and renders the beverage more acceptable to the stomach when the latter is weak.

Eggnog is still more nutritious than milk-punch, but is "heavier," and is usually rejected by the stomach if given too freely. It is made by beating up thoroughly the yolk of an egg with five fluidounces of milk and one or two tablespoonfuls of spirits (and a tablespoonful of lime-water if required), and adding a sufficiency of sugar, with, finally, the white of the egg previously beaten into a froth.

In conclusion, it should be said that, when stimulants are used to sustain the sinking vital powers in poisoning or in disease, the amount given should be regulated solely by the effects. "Thus, in snake-bite, it may be necessary to give a pint of whisky in the course of half an hour, and, in low fevers, great benefit result, and even life may be saved, by the administration of a quart of spirits a day. In poisoning, from one to four ounces, as the case may seem to need, should be given every ten minutes until some effect is produced or matters become hopeless." In low fevers, one or two tablespoonfuls are to be given every one, two, or three hours, according to emergency, the practitioner watching the results until its effects are manifested.

The evidence of physiological investigation goes to prove that digitalis in therapeutic doses is a powerful stimulant to the circulatory system. Digitalis in *moderate doses* stimulates the musculo-motor portion of the heart (probably its contained ganglia), increases the activity of the inhibitory apparatus, and causes contraction of the arterioles (probably by an action on the vaso-motor centers of the cord). As a consequence of the first action, the cardiac beats become stronger; as a result of the last, there is narrowing of the blood-paths, and to the passage of the vital fluid an increased resistance, which, acting on the already excited inhibitory system, aids in slowing the pulse. But it should be remembered that *toxic doses* of digitalis paralyze or weaken, more or less completely, each of the three systems, and cause rapidity of the pulse and falling of the arterial pressure.

In simple dilatation, or in simple failure of the cardiac muscle without valvular lesion, we get the most favorable results from the use of digitalis; but in pure, uncomplicated hypertrophy, it is distinctly contra-indicated. It is useful in mitral insufficiency and in mitral stenosis. In aortic constriction, it is useful when the heart-power begins to fail. It is used in irritability and in palpitation of the heart, which depend upon muscular weakness or exhaustion of the inhibitory nerves. In cardiac dropsy it is of service, not only by regulating through the heart the circulation, and by evacuating the surplus fluid through the kidneys, but also by an action on the vessels. The use of digitalis in large doses as a cardiac stimulant in *syncope* or in *sudden collapse* from hæmorrhage or other cause has been successfully demonstrated in a limited number of cases. H. C. Wood cites a number of cases in th-

Philadelphia Hospital where the hypodermic injection of the tincture of digitalis was followed by the most astonishing effects. He advises from twenty to thirty minims of the tincture injected into the arm, and repeated in half an hour if absolutely necessary. Closely allied to the last use of digitalis is its employment in *poisoning* by such substances as *muscaria*, *delphinia*, and *aconitia*, which arrest the heart in *diastole*, in which cases it exerts a real antagonism. Digitalis is often of great value in various acute diseases, such as *adynamic pneumonia* and *adynamic fevers*, by maintaining the action of the heart. It can have no effect upon the diseases themselves, but may help most opportunely to sustain the heart during a crisis or a period of strain upon it. The most convenient and available preparation is the tincture of the leaves of the second year's growth, given in doses of five to twenty drops every four to six hours, according to indications. In emergencies, a single dose of one or two fluidrachms have been given, and repeated in half an hour if necessary. Such large quantities may be given in delirium tremens for its sedative effect, but are regarded as hazardous.

Class VIII.—Sedatives.

The term sedatives, in its widest definition, includes all measures which exert a soothing action upon the system by diminishing pain, lessening functional activity, or tranquilizing disordered muscular movement; but there are certain drugs which are used by practitioners to decrease the activity as well as the force of the circulation, and these we shall consider under the head of *Cardiac Sedatives*. In reference to these agents, as Wood says, many, in fact all of them, possess other powers besides those which cause them to be considered under this caption, and none of them are in very close accord in these qualities. Of course, the chief indication for a medicine of this class is the existence of sthenic arterial excitement. The most important cardiac sedatives are tartar emetic, veratrum viride, and aconite. It is chiefly in inflammation that tartar emetic is used as an arterial sedative. In combination with more decided diaphoretics, it is constantly employed by some surgeons in fever after operations, in gonorrhœa, and in various sthenic inflammatory affections. But as this agent, administered in sufficient quantity to depress the circulation very decidedly, will also cause, generally, intense nausea and often purging, its use has been pretty much abandoned by modern therapeutists in favor of veratrum viride or aconite when they desire to depress the circulation very much in pneumonia or any other disease. The wine of antimony contains two grains to the ounce, and may be given in doses of fifteen to thirty minims every hour or two, either alone or in combination with opium, as circumstances may indicate. Veratrum viride in full therapeutic doses lowers the pulse-rate, both by direct action on the heart-muscle and by stimulating the inhibitory nerves. To reduce arterial action when true sthenic arterial excitement is to be combated in any disease, except it be *gastritis*, veratrum viride may be employed as a prompt, thoroughly efficient, and, at the same time, safe remedy—very safe, since it is almost incapable of producing death in robust adult patients, unless used with great recklessness and in repeated doses. In the early stages of *sthenic pneumonia* it is regarded as the best-known method of reducing the pulse-rate and the temperature, and of ameliorating the disease. In typhoid fever, and in other adynamic diseases, its use is contra-indicated. In *peritonitis* its tendency to cause vomiting is very much against its use. In chronic *cardiac diseases* it may be used in precisely those cases in which digitalis is contra-indicated—that is, where there is excessive hypertrophy. When administered as a cardiac sedative in almost all cases, vomiting is to be avoided as far as possible. To do this, small quantities of the drug should be given at short intervals, and corresponding doses of laudanum (five to ten drops) should be given with it. An hour is generally the best interval between the doses. The best form for administration is the fluid extract in doses of one to three drops, or the tinct- in doses of three to six drops.

In *aconite* we possess an efficient agent in lowering arterial action. It may be used with good results in *peritonitis*, where it is important to avoid vomiting. Its employment is very suitable in fevers of a sthenic type, especially in severe acute *muscular rheumatism* and in the *ephemera* or irritative fevers of childhood. In some cases of *hypertrophy of the heart*—when the valves are perfect, or when the valves, being diseased, the *hypertrophy* is greater than is necessary—aconite is of use to control cardiac excitement. When, however, there is dilatation of the heart or any degeneration of the heart-muscle, it is an exceedingly dangerous remedy, and is at all times to be avoided if the hypertrophy be not excessive. The most suitable preparation of aconite for internal administration is the tincture of the root, given in doses of one to five drops every one, two, or three hours, *pro re nata*, its effects being always watched. The safest plan is to give one or two drops every half hour or hour, so as to produce a steady and persistent influence in bringing about its desired effects as a cardiac sedative in vascular excitement.

Class IX.—Excito-Motors.

As the name indicates, the excito-motors may be defined as those drugs that increase the reflex activity of the spinal centers, and thereby give rise to disturbance of motility. The only representatives of the class used by the practitioner of medicine to exert a general stimulating influence upon the spinal centers are those drugs that contain strychnine as their active principle. Certain drugs exercising a stimulating influence upon special spinal centers will be considered under the head of *Oxytocics* and *Aphrodisiacs*.

Action.—In strychnine we possess an agent of unquestioned power as a neurotic. In toxic doses this drug produces severe and prolonged spasms, in which the body is arched, resting upon the head and heels. So terrible are these convulsions that death is commonly induced in an hour or two. It is noticed, however, amid all the motor perturbation, that the intelligence is unclouded and the consciousness unaffected. This leads to the conclusion that the spinal cord is the part chiefly affected by strychnine, and that it acts as a powerful stimulant to the spinal motor nerve-centers.

Uses.—The great influence of strychnine upon the function of voluntary motion early led to its use in cases of *paralysis*—often with the result of doing harm rather than good. In conditions of degeneration of the spinal cord, especially when of an anæmic character, and in certain conditions of adynamia, as in incontinence of urine, it is very useful, and most so in the dribbling of elderly persons. It is most useful in paralysis when dependent upon a *depressed state* of the *spinal* or other *motor centers*. Whenever these are the seat of *inflammation* or *irritation*, strychnine may do great injury by increasing such irritation, and must never be employed. Like galvanism in *hemiplegia*, it can only do a very limited amount of good, and should not be given until the irritation from the clot has ceased. It is especially useful in *lead paralysis*, and that which sometimes follows an attack of diphtheria. Strychnine also acts powerfully upon the vaso-motor and respiratory centers, increasing their activity.

Strychnine, in the form of the tincture of nux vomica (fifteen drops) and carbonate of ammonium (five grains), is urged by Fothergill as a capital substitute for alcohol in the treatment of adynamic conditions, and in commencing convalescence. Strychnine is often given associated with iron, and clinical experience has shown that it is a most useful tonic when there is anæmia and a general relaxation and loss of nerve-power. In such cases the author would recommend the following combination as an efficient and eligible preparation: ℞ Tr. nucis vomicæ, tr. ferri chloridi, acid phosph., dil., āā ʒiv; syrup. zingiberis, ℥jss. M. S. Teaspoonful three times a day. The dose of strychnine is one twentieth of a grain, best given in a solution of the sulphate three times daily, and which can be gradually increased until its physiological effects are manifested.

Oxytocics are those agents which are employed, during or directly after

parturition, to increase the uterine action. Strychnine undoubtedly induces contraction of the uterus, and is used by some practitioners instead of ergot, but is not considered so safe or available as the latter agent. Quinine is thought to exert an influence in this direction; but, if so, it is but feeble, and mostly due to its general stimulating influence upon the nervous system. Certain emmenagogues have been used as abortifacients; but, fortunately, they are but little to be relied upon for this purpose. Ergot alone is inefficient as an abortifacient. Tansy and savin are not only dangerous, but frequently fail to produce abortion, even when they destroy the life of the mother. The power of stimulating uterine contraction has been claimed for various other drugs, such as viscum album, ustilago, gossypium, cimicifuga, and borax; but, practically, the only drug much employed as an oxytocic is ergot. Upon the uterus of parturient women, ergot exerts a very pronounced and fixed influence, increasing the length and force of the pains, and, if given in sufficient doses, causing, after a time, a violent and tetanic cramp of the whole organ.

Owing to its power of intensifying labor-pains, it has long been used in *uterine inertia* during parturition; but it should never be given when there is much resistance either in the bony or in the soft parts of the mother. In women of lax fiber, with roomy pelvis, ergot may be used in uterine inertia if instruments are not at hand, or if they are objected to, or if the obstetrician is timid in their application. If ergot be given in very small doses during labor, the natural pains are simply intensified; but if the dose be large enough to have a decided effect, their character is altered: they become more severe and prolonged, and, finally, the intervals of relaxation are completely abolished and the intermittent expulsive efforts are changed into one violent continuous strain, and, if there is sufficient resistance, there is danger to the life of both mother and child. The danger to the mother is from rupture of the uterus or laceration of the perinæum. The danger to the child is even greater, by cutting off the blood-supply from the placenta by the continuous instead of intermittent contraction of the uterus which nature provides. At the close of parturition, ergot is very commonly and properly used for the purpose of preventing *post-partum hæmorrhage;* but, as it requires from fifteen to twenty minutes for its action when given by the mouth, it can not be relied upon to arrest flooding when it has already set in. To prevent its occurrence, however, it is an excellent rule to give a full dose of the oxytocic when the child's head is well down upon the perinæum, and beginning to emerge at the vulva. After labor, if a tendency to bleeding is manifested, the exhibition of ergot may be added to the other measures employed. The best preparation of ergot is the fluid extract, which may be administered, as an oxytocic, in doses of from one to two fluidrachms.

Aphrodisiacs are those medicines which increase the sexual appetite and power.

Aphrodisiacs may act by increasing the excitability of the nerves passing to and from the genital organs, or that of the genital center in the spinal cord. In this way an influence is exerted by strychnine or nux vomica, phosphorus, and probably damiana; or some may act by causing irritation of the nerves of the genital or urinary organs, or of adjoining parts, as is the case with cantharides; while some act by stimulating the brain, as Indian hemp or small doses of opium. Alcohol, in large doses, has a double action in increasing the sexual desire by stimulating the brain while lessening the power of erection, probably by weakening the nerves through which the spinal center acts on the genital organs, or depressing the center itself. As the sexual passion becomes diminished when the nervous system is weakened with the rest of the body, and increases with returning strength, iron, with bitter tonics and generous diet, act indirectly as aphrodisiacs.

When the sexual functions are abnormally depressed, *strychnine* and *phosphorus* are the most generally useful of the direct aphrodisiacs; they may given separately or in combination with damiana. But the latter agent is doubtful utility. Cantharides, though sometimes valuable, must be given

with caution. The aphrodisiac dose of the tincture of cantharides is three to eight drops three times daily, well diluted.

Class X.—Depresso-Motors.

In this class are considered certain drugs which are used for the purpose of lessening the activity of the spinal cord. Of the neurotic agents which diminish action in the nervous system, those which deserve prominent mention are calabar-bean, the bromides, chloral hydrate, and veratrum viride.

It now seems clearly established that physostigma exerts a powerful depressant action upon the spinal centers, which very early led to its use in spasmodic affections, and especially in *tetanus*, with more than ordinary success. It has also been employed in *strychnine poisoning*, and recovery has been reported after the ingestion of three grains of the latter alkaloid. It has been used with success in chorea and spasmodic cholera. It may be used hypodermically. A good form of administration is the tincture dose, one to ten drops. In convulsive diseases of all kinds the bromides are most valuable, especially when associated with some distant irritation, or of reflex origin. In *epilepsy* they have obtained a most deserved reputation, doing more good than all the other remedies combined. The governing principle is to try them in every case, increasing the dose until a mild degree of bromism is induced, and being guided by the results. The *bromide of potassium* is most generally used, but that of ammonium may be given in connection with it. The bromide of potassium is often efficacious in other reflex spasmodic neuroses; in the *vomiting of pregnancy*, or of uterine disease; in the *convulsions* of children; in *strychnine poisoning*. It is considered the best of all known remedies in the treatment of *tetanus*. But for this purpose not less than half an ounce of the salt should be given during the day, and at night sufficient chloral hydrate to induce sleep. Aside from the last two uses of bromide of potassium, most other indications are best met by the so-called continuous method of administration—so much three or four times a day until the desired effect is induced. Thus, in epilepsy, half a drachm may be given four times a day, increased to a drachm, making it half an ounce daily when necessary, although as little as will suffice to prevent the recurrence of the fit should be used. It should be given in solution, freely diluted, after meals. In some cases it causes diarrhœa; to obviate this, camphor-water is the best vehicle, and small quantities of opium may be added.

Another powerful agent for depressing nervous action is *chloral hydrate*. It is very commonly useful in the convulsive disorders of children, and in some cases of chorea; and even in *tetanus*, *puerperal* and *uræmic* convulsions, it has been used with advantage. It should, in the latter cases, be given in full doses (twenty to forty grains), diluted with weak syrup. Another agent for depressing nervous action, and which exerts a paralyzing influence upon excito-motor nerve-centers and ganglia, is *veratrum viride*. In the *convulsive attacks of young children*, due to high temperature and irritation from dentition, nothing more suitable can be employed than a combination of tincture of veratrum viride and bromide of potassium, which promptly control the temperature and calm the nervous excitement. Recently tincture of veratrum viride has been much lauded as a remedy for *puerperal eclampsia*. It should be given in doses of twenty to thirty minims of the tincture every hour, or doses sufficiently large to reduce the pulse to sixty or eighty beats per minute, and, to maintain this effect, may be employed hypodermically.

Certain agents appear to exert, in addition to their general depressing effect upon the spinal centers, also a special influence. Among special *uterine sedatives* may be mentioned *viburnum prunifolium*. This agent acts as a sedative to the spinal centers, especially those governing the uterine functions. It is highly recommended in cases of *threatened abortion*, whe" accidental or due to the action of drugs, and is said to be especially se

able where a tendency to abortion exists from habit. In these cases it may be given in doses of ℨj of the fluid extract every two or three hours as long as abortion is threatened. It is also recommended to allay the severity of after-pains, and is one of the numerous remedies which have been used for the relief of the vomiting of pregnancy. It is likewise employed in menorrhagia, metrorrhagia, and in neuralgic dysmenorrhœa. In the menorrhagia, accompanied with nervous symptoms, appearing at the climacteric period, its use has been especially praised. The *fluid extract* is officinal; the ordinary dose is fℨss. to fℨj.

Antaphrodisiacs are those drugs which diminish sexual passion, and they act by lessening the excitability of the nerves of the genital organs, or by diminishing the excitability of the genital centers in the spinal cord. The most useful are camphor, conium, lactucarium, lupulin, and bromide of potassium. These agents may be usefully employed to lessen the sexual passions when they are abnormally excited in satyriasis, nymphomania, and allied conditions. As such excitement may sometimes depend upon local irritation of the genitals, in consequence of prurigo of the external organs, excoriation of the os uteri, or balanitis, or on the presence of worms in the rectum or vagina, these sources of excitement should be looked for, and, if present, should be subjected to local treatment.

"In cases of hyperæsthesia or irritability of the reproductive organs, the effects of bromide of potassium are well known. Where the system is suffering from suppression or repression of the sexual instinct, as in involuntary celibacy, this drug possesses an almost unique power. Consequently, it is very useful in the treatment of menorrhagia in girls and young women, and again at the menopause, where there is often much sexual excitement, indeed a recrudescence of the generative instinct; but in other forms of menorrhagia, and in flooding from uterine tumors, it is useless." (Ringer.) Besides those agents which lessen the excitement of the vaso-inhibitory nerve-center of the lumbar portion of the spinal cord, whose function is to regulate the circulation in the genital organs, there are also adjuvant measures of a hygienic or moral character, which greatly assist and may even replace antaphrodisiac medicines—such as meager diet, especially of a vegetable nature, the avoidance of stimulants, and the pursuit of active mental and bodily exercise. Everything tending to stimulate the genital organs, or to increase the flow of blood to them or to the lumbar portion of the spinal cord, should be avoided—such as warm and heavy clothing, or pads about the hips or loins—and a hard mattress should be used in place of a feather bed. Everything likely to arouse the passions—such as certain novels, pictures, theatrical representations, etc.—should be shunned.

Division IV.—Topicals.

This division of therapeutic agents, sometimes called *local*, in contradistinction to *general*, remedies, includes those drugs whose action is confined to, or seem specially to affect, a particular part of the body with which they come in contact. Some of them act externally to the body, affecting some material foreign to the system, some extraneous material or entity either in the cavities of the body or upon its exterior. Thus an absorbent may remove acid and foul excretions and gases from the intestinal canal. An anthelmintic kills the tape-worm or other entozoa in the bowels, while disinfectants destroy poisonous emanations in the exterior world, and thereby ward off disease.

Class I.—Digestants.

Under the head of digestants may be included all those medicinal substances used for the purpose of promoting digestion, whether they act by increasing the flow of the natural digestive fluids, or those which act artificially in the solution or digestion of alimentary substances.

Those which act in the first manner comprise certain agents formerly

known and still called stomachics. This list contains agents otherwise possessing widely different properties. Thus, *alcohol*, *arsenic*, *ipecacuanha*, *capsicum*, and other substances may be grouped together. They all, says Fothergill, possess this property in common: they increase the vascularity of the stomach, in small doses; in large ones, they act like irritant poisons and produce inflammation of the stomach. They are all apt to produce vomiting in excess; and their continuous administration in liberal quantities produces an irritable condition of the stomach. Physiological experiment upon animals, as well as clinical experience, goes to show that a small quantity of alcoholic stimulants improves digestion, and with it a meal with many persons can be digested which may not otherwise be possible. For this purpose it must be taken after meals; the same applies to the use of the other agents of this class. Arsenic produces a vascular flow in the stomach, often very useful. In large doses, it produces irritability and inflammation; it is a difference of degree. Ipecacuanha produces a vascular flow to the mucous lining of the stomach; in larger doses, vomiting results. It is a very useful agent to combine with pepsin. In former days an excellent dinner-pill was composed as follows: ℞ Pulv. ipecac., ext. cinchon., of each, gr. j; pil. aloes et myrrh, gr. ij. According to Ringer, alkalies given just before meals promote the flow of gastric juice; for this reason they would form a useful addition to stomachic mixtures.

Of digestants proper, which are used to aid the stomach in dissolving the various articles of food, there appear to be but three articles worthy of mention—namely, *pepsin*, *hydrochloric acid*, and *lactic acid*. The value of pepsin has probably been vastly overestimated, and it has been given to adults in doses entirely too small to do any good. *Pepsin* is certainly more efficient with children than grown persons, and in the chronic indigestion and the chronic diarrhœa, as a result with young children, it may be employed with great hope of benefit. To a baby six months old, five grains of commercial pepsin may be given in a little acidulated water after each feeding. Alcohol destroys the digestive power of pepsin, and therefore, and for this reason, the so-called wines of pepsin are ineligible preparations. The reaction of pepsin with organic or inorganic matters is very complex and not well understood; for this reason all elixirs and compound preparations of the drug should be avoided. In making the digestive fluid, water and muriatic acid, or glycerine, water, and muriatic acid, should alone be employed with the pepsin. The chemically pure or scaled pepsin is much more reliable than the two-per-cent saccharated pepsin to be found in the market. The former, in five-grain doses, with the fourth or half grain of ipecac, dispensed in powders after each meal, is very efficient. Hydrochloric acid is best given in the form of the officinal *Acidum Muriaticum Dilutum*—dose, ten to thirty drops—and, when properly diluted, with or without pepsin, is often useful by aiding the digestion of food.

Lactic acid appears to be the natural acid of the gastric juice, and may with propriety be used as an adjuvant to pepsin in doses of half a drachm, well diluted, three times a day. This is the only way in which it is employed internally in medicine, though it is sometimes used for its solvent action upon diphtheritic exudations. Recently a preparation called ingluvin, obtained from the gizzard of the domestic fowl (chicken), has been introduced as an efficient adjuvant to digestion. It is regarded as a valuable and reliable remedy for *gestal vomiting*, and for the relief of *dyspepsia* and *sick stomach*. It is claimed to be superior to pepsin preparations, acting with more certainty, and effecting cures where they fail. It may be given in doses of five or ten grains, either alone or in combination with hydrochloric or lactic acids.

Class II.—Astringents.

Astringents are defined as those drugs which cause contraction of living tissues. According to H. C. Wood, they do not act, as has been supposed either by coagulating albumen or by calling into action the muscular fi

tion, since this is demonstrated by the transitoriness of their effects and by the fact that they influence tissues containing no muscular fiber. Every living tissue appears to possess a normal degree of condensation, which may be departed from in one way or another. When this happens, the part is said to be relaxed in the one case, in the other to have its tonicity increased, or to be astringed. The action of astringents is always a *local one*—that is, produced not through the intervention of the nervous system, but by direct contact with the part affected.

A pure astringent should be capable of doing nothing beyond inducing contraction; but in reality there is scarcely any such drug. All astringents are, when applied too freely, irritants; and, in fact, their therapeutical property of astringency is probably due to a mild form of irritation. Astringents are usually divided into two groups: the vegetable and the mineral. Tannic acid and the drugs which contain it constitute the former class, while in the latter group are included various substances of diverse therapeutic power.

The indications for the use of astringents may be mentioned as follows:

1. *To counteract relaxation.* 2. *To check morbid discharges.* When either of the foregoing conditions is the result of inflammation, the use of astringents requires caution, especially for the latter condition, as free excretion is often nature's method of relieving local inflammation. If free alvine discharges are the result of intestinal relaxation, the astringents are most valuable; but when such discharges depend upon enteritis or colitis, astringents do harm. Another indication for the use of astringents is to *check hæmorrhage*, and the same cautions are applicable to this as to the other indications. Hæmorrhage, dependent upon overaction, demands other treatment than by astringents. Sometimes in these cases, however, it is necessary to check hæmorrhage at all hazards, and then astringents may be used in conjunction with other measures, although they may be to some extent contraindicated. Various astringents are employed locally to check hæmorrhage due to traumatic or other ruptures of vessels. In such cases the astringents are employed as *styptics*, and do not act by their astringency so much as by coagulating the albumen of the blood and mechanically arresting the flow by forming a clot. Under certain circumstances there seems to be a general relaxation or loss of tone throughout the whole system, which may be met by the united action of tonics and astringents.

The active principle of the *vegetable* astringents, as has been remarked, is tannic acid; and, as it is almost their sole therapeutic principle, and represents them very closely, its action and use may be briefly considered first, and then any special therapeutic virtues of the crude drugs of this class may be pointed out afterward.

Tannic acid comes the nearest in representing a pure astringent. As it coagulates albumen, it can not be absorbed into the blood. When taken into the stomach, a portion of it is converted into gallic acid, and, as it must undergo this conversion before absorption, it is evident that gallic acid is to be preferred when the part to be acted upon is to be reached through the circulation. As a local application, tannic acid is much more powerful than gallic acid, and in this way may be applied to overcome relaxation of mucous membranes; and for checking hæmorrhage it may be used when the source of the flow can be reached directly, as in *hæmatemesis* and *hæmorrhage from the bowels*. To arrest excessive excretion, it may be employed locally in *leucorrhœa*, *diarrhœa*, and for various diseases of the skin. It is often very useful for hardening parts exposed to friction, as in cases of sore nipples and tender feet. When given to act on the stomach, as in hæmatemesis, tannic acid should be in powder (ten to twenty grains). When the bowels are to be influenced, as in diarrhœa, the drug should be administered in pill (three to five grains), so that, if possible, it may pass the pylorus undissolved. For local use, the glycerite of tannic acid (one part to four) is an eligible preparation.

Gallic acid is a useful astringent in *hæmoptysis*, *hæmaturia*, *colliquative sweating*, etc. It has been recommended in bronchorrhœa, and in certain

forms of Bright's disease when there is an abnormally large excretion of highly albuminous urine, the albumen of which it lessens very materially. The dose of gallic acid is from five to fifteen grains, or even more in powder or in pill. As it is soluble in the proportion of one part to eight of alcohol, and as this does not precipitate by the addition of water, a very good form for internal administration, especially for albuminuria, is the following spirituous solution: ℞ Acid gallici, ʒj; sp. vin. recti., ℥j. S. Teaspoonful in water every four hours.

The tincture of *catechu*, in doses of one to two fluidrachms, and the tincture of *kino*, in doses of one fluidrachm, are useful astringents for diarrhœa. A very efficient formula for children is as follows: ℞ Tr. catechu and tr. opii. camph., each ʒij; mistura cretæ prep., ℥ijss. M. S. Teaspoonful every three or four hours for a child one to two years of age.

Hæmatoxylon is a mild, efficient astringent, valued on account of its sweetish taste. It is readily taken by children, but is sometimes objected to on account of staining the diapers. For adult patients, Professor H. C. Wood offers the following formula as an efficient and elegant remedy for *diarrhœas* of relaxation; the proportions may be varied to suit individual cases: ℞ Ext. hæmatoxyli, ʒij; acid. sulph. aromat., ʒiij; tinct. opii. camph., ℥jss.; syrupi zingiberis, q. s., ad. f℥vi. M. Dose, a tablespoonful, properly diluted.

Of the *mineral* astringents, alum salts, and those of lead, zinc, bismuth, and of silver may be mentioned as the most useful.

Alum may be used locally to serve all the purposes of an active astringent. It has been employed very frequently with success as a styptic to arrest hæmorrhage, and applied, by atomization of its saturated solution, for restraining hæmoptysis and in bronchorrhœa. In *colliquative sweats*, sponging at bed-time with alum-water often proves an efficient measure. In the proportion of ʒj to Oj of tepid water it forms a cheap and useful wash for *leucorrhœa*. Alum-curd may be made by dissolving two drachms in a pint of milk and straining, or by rubbing the alum with the white of egg. It forms a useful application in *chronic ulcers* with exuberant granulations, and in *conjunctivitis*. As an astringent, the dose of alum is from ten to twenty grains. The *acetate of lead* is very largely used, in acute external inflammations, as a *sedative* and *astringent* lotion. Internally, it was formerly regarded as the most useful of all astringents in *hæmoptysis*, especially when combined with opium; its sedative influence upon the circulation increases its value for this purpose. At present it is used chiefly for diarrhœa. On account of its sedative properties, when the purging is attended with inflammation, it is the most serviceable of all the astringents, and, owing to the promptness of its action, it is also very valuable in cases with profuse serous discharge. The following mixture for this purpose, as in cholera, or obstinate diarrhœa of a passive character, is, perhaps, the most efficient that can be employed: ℞ Plumbi acetatis, ʒss.; morphinæ acetatis, gr. j; acidi acetic, ♏xx; aquæ, ℥iij. M. S. Tablespoonful three hours after each meal. The foregoing formula is, in suitable doses, very efficient in cholera infantum. For external use, the *carbonate of lead* is an excellent sedative astringent application. Rubbed up with linseed-oil, it constitutes white-lead paint, and in this form, or in that of an ointment with cosmoline, it is a most efficient application for burns.

The preparations of *bismuth* are of great service in various forms of irritation of the alimentary canal. In the various forms of diarrhœa, and especially in the chronic bowel complaints of children occurring during the summer season, given with pepsin they are almost invaluable. Topically, they are employed as sedative astringents in leucorrhœa, gonorrhœa, and irritable ulcers. The subnitrate and subcarbonate have almost identical therapeutic properties, and the one can be substituted for the other when desired. The dose of either should be much larger than formerly used. To infants, from five to ten grains may be administered for a dose, and, for adults, from twenty grains to a drachm. The *sulphate of zinc* in weak solution is a stimulant astringent; in concentrated form, it is an active irritant. It may be taken in doses

of two grains as a stimulant astringent in *chronic diarrhœa* with ulceration. In the strength of two to five grains to the ounce of distilled or rose water, it forms a useful injection in gonorrhœa, and wash for subacute ophthalmia. Sulphate of morphine and glycerine often render it less irritating and more efficient. The *oxide of zinc* is used externally as a mildly astringent and desiccant application in *skin diseases* and to *ulcers*. The officinal benzoated oxide-of-zinc ointment is a very superior remedy for the above purposes. The oxide of zinc, in doses of five grains, may be employed in diarrhœa. In doses of one to two grains it is to be commended in infantile diarrhœa, the drug to be repeated every three or four hours until the bowels are checked.

Nitrate of silver is most frequently employed in therapeutics for its local action, either upon the surface of the body or upon those mucous membranes that can be reached directly by the drug. In *faucitis* it is used in solution of the strength of fifteen to thirty grains to the ounce. In *laryngitis*, a solution of from ten to twenty grains is sufficiently strong. In *advanced stages of gonorrhœa*, weak injections (grs. j to ii to ℥j) are often very serviceable. Internally, the nitrate of silver is very useful in *chronic gastritis* and *gastric ulcer*. It should be administered in pill form, one quarter to one half grain, three or four times a day, taken when the stomach is empty. In very serious cases, when all food is rejected by the stomach, it is sometimes advisable to allow absolute rest for two or three days, the patient being fed by the rectum, and only a little water and pills of silver with opium being taken by the mouth. After this, a tablespoonful of milk and lime-water may be taken every hour. In chronic enteritis or colitis, nitrate of silver is sometimes of great service, especially if there be ulceration. It should be given on an empty stomach, one or two hours before meals.

Class III.—Anthelmintics.

These are medicines which kill or cause the expulsion of intestinal worms. They may be grouped according to their action upon different species of entozoa, since clinical experience has demonstrated that an anthelmintic very efficient against one form of intestinal worm may not be injurious to another species. Therapeutically considered, the entozoa may be divided into the *Round-worms* (*Lumbrici*), *Tape-worms* (*Tænia*), and *Seat-worms* (*Ascarides*). The last of these differ from the others in that they are to be attacked solely by enemata.

It is evident that the value of an anthelmintic depends not only upon its power of poisoning the worm, but also upon its harmlessness as regards the patient. Thus it is the union of these qualities which renders the infusion of quassia so valuable in cases of seat-worms, while carbolic acid, though very efficient, should never be used against the same parasite, since it has greatly imperiled, if it has not destroyed, the life of the patient when so employed.

There are certain general rules which govern the administration of anthelmintics and which should be remembered. They may be briefly stated as follows: Let the alimentary canal be as empty as possible, so that the drug may act with the greatest force upon the entozoa, unshielded by food and mucus. For this reason, vermicides are best given early in the morning, after as long a fast as possible, and in obstinate cases the fasting should be continued until dinner-time.

"If the anthelmintic is not itself a purgative, from four to eight hours after its administration a brisk cathartic should be given, or a purgative dose of calomel may be combined with it, as the bilious purging induced by the latter drug seems to be especially obnoxious to the entozoa." (Wood.) An insufficiency of common salt in the food is thought to favor the development of entozoa. And, as abundance of mucus in the intestines forms a convenient nidus for the growth of worms, anything that diminishes this tends to prevent their occurrence; and for this purpose preparations of iron and bitter tonics are useful. Among the most efficient remedies for the expulsion of

the *round-worm* may be mentioned spigelia, or pink-root, which is, when given within the bounds of moderation, perfectly safe. It appears to narcotize the worm, and requires the use of a brisk cathartic. For this reason the fluid extract of spigelia and senna is the best preparation of the drug, and is much liked by children on account of its agreeable taste. The dose for an adult is f℥ss.; for a child two years old, fʒss. to fʒj, repeated every four hours until it purges. Should worms be expelled, the preparation may be continued by giving a dose each morning before breakfast. *Worm-seed oil* (*Oleum Chenopodii*, U. S.) is also very efficient against the lumbricus; ten drops of it may be given to a child, three years old, before breakfast, dinner, and supper, for two days, followed by a brisk purge. One of the most reliable remedies for *lumbricoid* or *round-worms* is santonin. It is a parasiticide, killing or intoxicating, but not expelling the worm, and, consequently, should be used in combination with or followed by a brisk cathartic, such as the compound extract of colocynth. Especial advantage is to be derived from the joint use of these drugs and calomel. The dose of santonin for an adult is two to four grains, for a child two years old one fourth to a half-grain. For young infants, santonin is hardly a safe remedy in any efficient dose. When a dose of any size is given, it should not be repeated in less than eight hours, and the last dose should be followed by a purgative dose of calomel.

For the expulsion of tape-worms, male fern has been of long and well attested efficacy. The *oleoresin* (*oleoresina aspidii*) is the best preparation. It is a dark, thick liquid, of a bitterish, nauseous, slightly acrid taste; dose, fʒss. to fʒj, night and morning, for a day or two, to be followed by a cathartic. The administration of the tæniacide agent should always be preceded by a twenty-four hours' fast. *Kamala* (formerly called *rottlera*) is a highly esteemed tæniacide in India, and has been lately introduced into Europe and our own country. Dose of the *powder*, ʒj to ij, suspended in syrup. Castor-oil should be taken after the medicine. The seeds of *cucurbita pepo*, or common pumpkin, is probably the most efficacious remedy known for the expulsion of tape-worm. They owe their activity to a principle soluble in ether, chloroform, and especially alcohol. One or two Troy ounces of the *fresh seeds*, deprived of their outer envelope, beaten to a paste, with finely powdered sugar, and diluted with water or milk, should be taken after a twenty-four hours' fast, and followed in two or three hours by a dose of castor-oil. A fluid extract made with alcohol and glycerine is probably the best preparation; dose, f℥ss. to j. The bark of the pomegranate-root (*Granati Radicis Cortex*, U. S.) is an efficient though a very unpalatable remedy against the *tape-worm*. The decoction of the fresh root (℥ij to Oj) is to be preferred—a pint of it to be taken in three doses, an hour apart, before breakfast. In connection with the use of the last-named agent, it should be stated that the difficulty of procuring it of good quality, and the disagreeable taste of the decoction, have greatly restricted the employment of this very efficient remedy.

But, fortunately, the famous French chemist, M. Tanret, of Paris, has recently succeeded in discovering and isolating, in a perfect state of purity, the alkaloid to which the bark of pomegranate-root owes its property, which he has seen fit to call *Pelletierine*, in honor of the illustrious chemist Pelletier, who, in collaboration with Caventou, discovered quinine and so many alkaloids of common use. In the actual state of our knowledge, Pelletierine, administered with proper precautions, is regarded as the most powerful tæniafuge we possess. Under its action the worm rolls itself in a ball, in the center of which it hides its head, and is expelled like an inert mass. Before taking the remedy, the intestines should be freed the day before by a copious injection or a slight laxative. The patient should take only a little milk at the evening meal. In the morning, on an empty stomach, half a glass of water is taken, then the dose of Pelletierine (three to five grains), and in an hour a suitable purgative, such as infusion of senna, which may be repeated within a few hours in case the bowels are not freely moved, it being important *that the purgative act rapidly.*

Class IV.—Irritants.

Under this class may be considered all those drugs that are employed to produce irritation or inflammation of the parts to which they are applied. They may be subdivided into rubefacients, epispastics, suppurants, and escharotics. *Rubefacients* are used merely to produce redness of the skin. *Epispastics*, or *vesicants*, cause the exhalation of a serous fluid under the cuticle. *Suppurants* produce a crop of pustules. *Escharotics* have a chemical action on the tissues with which they are placed in contact, and decompose or destroy them.

Theory of Counter-irritation.—From time immemorial, it seems to have been a practice in the art of medicine to resort to agents capable of exciting activity, and especially vascular activity, in a part, when applied locally to relieve abnormal action going on elsewhere. This artificially excited action was supposed to relieve and reduce the pre-existing malady; and this line of treatment has been denominated variously, according to circumstances, irritation and counter-irritation. "It took its origin, probably, in observations of the following kind: In the exanthemata, the more copious the eruption the less the internal complication, ordinarily at least; and that any retrocession of the eruption was likely to be followed by some internal complications of increased gravity. In the metastasis of mumps, or of articular rheumatism, etc., as soon as another part became affected, the part originally implicated was relieved. For this reason, our predecessors had cause to believe that setting artificially some irritation elsewhere would exercise a beneficial effect over the disease they were essaying to treat. There was an element of truth in these conclusions." Evidently there is only a certain amount of blood in the body. If it be accumulated in one place, it can not be in another, which fact very clearly explains the difficulty of studying after a hearty dinner, and the cold feet so common in feeble persons under such circumstances—effects dependent upon the accumulation of blood, and perhaps of nervous energy, in the digestive organs. And also why, by artificial interference, by determined study, by violent exercise, which tend to draw away the blood from the alimentary apparatus into the cerebrum or into the motor apparatus, indigestion is produced. "Clinical experience proves that we can also reverse this process. The brain is excited, the blood is concentrated in it, hyperæmia or congestion exists, inflammation is threatened, or even effusion may have occurred. A drastic cathartic is given, the blood is drawn into the intestinal canal, and, by revulsion, the brain is relieved." Hot foot-baths and blisters to the legs are also found useful in diminishing the congestion of the encephalon. The experienced practitioner knows full well the value of blisters to relieve and to diminish accumulations in the serous sacs, as of the thorax and abdomen, and the articulative effects which have been explained in the fact that the vascular supply of deep-seated parts is derived from the same arterial trunks as that of the superficial parts. Any dilatation of the cutaneous branches and increased blood-flow in the superficial distribution will diminish directly the current in the deep-seated vessels. "Thus, in inflammation of the pleura—that is, the costal pleura—the application of dermal irritants, either heat or vesicatories, will dilate the cutaneous terminations of the intercostal arteries, and so diminish the blood-supply to the pleural arterioles, and, in this way, lessen the vascularity of the inflamed area. In the same way, dilatation of the cutaneous vessels of an articulation, say the knee, will be followed by a lessened blood-flow in the deep articular branches of the arterial trunk common to both." So far as these effects are concerned, the *modus operandi* of counter-irritants is easily explained. But all forms of counter-irritation can not be explained from the mere hydraulic side of the question, the effects being sometimes due to an influence exerted through the vaso-motor nervous system. We all know, says Fothergill, that plunging one hand into cold water will lower the temperature of the other hand, and that "cold applied to a part of a bat's wing causes contraction of the vessels of the corresponding part of the opposite wing." The duodenal ulcer of burns may be

cited as a positive proof that external irritations may and do produce internal reflex alterations of nutrition through the vaso-motor nervous system. The sympathetic ophthalmia caused by a morbid eye in the opposite one, which was healthy, or that which is induced by a diseased tooth, is another instance of this reflex alteration of nutrition. From all this we can understand how it may be that counter-irritation may exercise a beneficial effect in cases of inflammation, where the vascular supply of the inflamed part is not derived from the same arterial trunk as that of the cutaneous surface operated upon.

As well as these more localized effects of external application, there are wider and more general consequences of their employment. Thus, the application of rubefacients to large areas of surface in cases of collapse, shock, or even the typhoid condition, is a well-established practice. Dermal irritants in these conditions have a direct tendency to arouse or excite the system, and may be used as general stimulants.

Uses.—Rubefacients are employed to remove congestion and inflammation, to raise the capillary system in cases of local torpor, to relieve pain and spasm, and as stimulants to the general system in coma, syncope, asphyxia, etc. They are adapted to cases in which a sudden and powerful but transient action is called for; but they may be also employed where a slight and long-continued action is desired. In removing congestion and inflammation, rubefacients are more useful in their forming stages or in their lighter grades. They are very serviceable local anodynes when applied to painful parts, acting by a *substitutive* influence. As general stimulants, their efficacy in rousing the system depends partly on their action on the capillary circulation, and partly on the pain which they produce. They are most valuable in the coma or asphyxia resulting from poisons, drowning, and collapsed conditions due to sudden depression, rather than in advanced exhaustion; their application should be brief, and accompanied by the exhibition of other stimulants somewhat freely. Rubefacients are inferior to blisters in the cerebral oppression which occurs in fevers, inflammation of the brain, and other deep-seated organs; the latter being of more permanent influence, but the former having the advantage, when it is desirable for any reason, to affect a large extent of surface. Rubefacients are usually applied till pain and redness supervene. If kept too long on the skin, many of them will produce vesication, and even gangrene; and, in cases of coma, particular caution is required, as the patient may not feel them till dangerous inflammation has occurred. One of the most useful rubefacients is mustard.

A *sinapism* is made by mixing flour of mustard with a sufficient quantity of tepid water to give it proper consistence, and it may be diluted with wheat-flour if a weaker effect is desired. Sinapisms are used when a speedy and powerful rubefacient is required; they may be kept on until pain and redness are produced, usually from a quarter of an hour to an hour, and in cases of insensibility their effects should be carefully watched. They are applied spread on linen, and covered with gauze to prevent adhesion to the skin. Mustard is the most active, and at the same time the most easily controlled, of the rubefacients. A mild but permanent effect may be kept up by the addition of a teaspoonful to a tablespoonful of mustard to a poultice of Indian-meal or flaxseed, with a tablespoonful or two of capsicum. For ready use there is now prepared and kept for sale *charta sinapis* (*mustard-paper*). This is made by mixing black mustard (in powder) with enough solution of gutta percha to give it a semi-liquid consistence, and then applied by a brush to a piece of stiff paper; each square inch contains about gr. vi of mustard. Before applying to the skin, it should be dipped for about fifteen seconds in warm water. The *linimentum sinapis compositum* (*compound liniment of mustard*) is composed of volatile oil of mustard (3 per cent), extract of mezereum (2 per cent), camphor (6 per cent), castor-oil (15 per cent), and 74 per cent of alcohol.

The *oil of turpentine* is a speedy and efficacious rubefacient, and it sometimes produces a vesicular eruption. It is employed in low forms of disease attended with coldness of the surface, as a counter-irritant in inflammation, and as a stimulating liniment in rheumatic and paralytic cases. It is often

diluted with olive-oil. Its most frequent application is in the form of *stupes*, which should be made by dipping a piece of flannel, previously wrung out with warm water, into a cup of turpentine, then wringing out the excess of turpentine and applying. These stupes may be left on from ten to thirty minutes, according to the severity of the impression desired and the susceptibility of the patient's skin.

The *liniment of ammonia*, called also *volatile liniment*, is now made by the addition of three parts of aqua ammoniæ to seven parts of cotton-seed oil, and forms an excellent application, as a counter-irritant, in affections of the throat and chest, etc.

Burgundy pitch is a gentle rubefacient, producing a slight degree of inflammation and serous effusion without separating the cuticle. Its effects rarely extend beyond this, though it occasionally produces a papillary or vesicular eruption, and sometimes, though rarely, vesication. It is applied in the form of a *plaster*, to the chest, in chronic and subacute pulmonary disorders, to the loins in lumbago, to the joints in chronic articular affections, and for the relief of local rheumatic pains in other parts.

The *emplastrum picis Burgundicæ* consists of nine parts of Burgundy pitch melted with one part of yellow wax, which is used to give consistence to the pitch. *Emplastrum picis cum cantharide* (pitch plaster with cantharides) consists of ninety-two parts of Burgundy pitch melted with eight parts of cerate of cantharides; this is commonly called the *warming plaster*, and is a more active rubefacient than Burgundy pitch alone, though it does not usually blister.

Epispastics, called also *vesicants* and *blisters*, are medicines which, when applied to the skin, produce inflammation accompanied by effusion of serum beneath the cuticle. Many of the rubefacients will blister if kept on the skin a sufficient length of time, and, on the other hand, the action of vesicants may be made not to extend beyond rubefaction. The inflammation caused by blisters is erysipelatous in its character, and may result in suppuration, and even sloughing or gangrene. In inflammation of the dermoid tissues, as rubeola and scarlatina in extreme infancy or advanced life, vesicants may produce serious consequences. This group of agents is employed: 1. As *local* revulsives, by determining vascular and nervous energy to the seat of their operation. In affections of the brain, blisters are pre-eminently useful. 2. To substitute a healthy therapeutic inflammatory action, which subsides spontaneously, for a morbid action existing in the part to which they are applied; in this way vesicants are used for the cure of various cutaneous eruptions. 3. To relieve pain, which they do by a revulsive or substitutive influence. 4. To break up a train of morbid associations by the powerful impression which they make on the nervous system, as in the cure of intermittent fever, spasmodic diseases, etc. 5. To stimulate the absorbing vessels of parts contiguous to the seat of their application; in this way they are useful in promoting the absorption of dropsical effusion. 6. As general stimulants in typhoid conditions of the system, coma, and syncope. 7. As evacuants, chiefly for the purpose of local depletion. 8. To antagonize retrocedent gout and retrocession of the exanthematous eruptions. 9. To prepare a surface for the endermic application of medicine, especially of morphine.

"The *contra-indications* to the use of blisters are high arterial and febrile excitement and a decided want of vital power. In the former case the irritating influence which they exert upon the general system may increase the constitutional disturbance to such an extent as to do far more injury than any local benefit derived from them can do good. When the vitality is very weak, blisters may give rise to sloughing ulcers, which, refusing to heal, may waste very seriously the already exhausted system."

Of the various substances capable of producing vesication, the only one in ordinary use is cantharides, which is to be preferred to all other substances as an *epispastic*. The following are the forms under which Spanish flies are used externally:

Ceratum cantharidis, commonly known as *blistering cerate*, is made by

mixing powdered cantharides (thirty-five parts) with melted wax and resin (each twenty parts) and lard (twenty-five parts). This is the preparation usually employed to raise a blister. It can be applied without the aid of heat, and should be spread on soft leather, linen, or adhesive plaster, and covered with gauze or unsized paper. From four to twelve hours is the period for which cerate should be applied on the scalp; even a longer application may be required. For an ordinary impression, and where the cutaneous sensibility is not impaired by disease, it need not be kept on more than four or five hours. Very rarely indeed is a blister called for in the case of a young infant, and, when employed, it should be allowed to remain in contact with the skin only just long enough to produce slight redness, and then complete vesication by the use of a bread-and-milk poultice, or of flaxseed-meal. If it be desirable to heal the blistered surfaces immediately, cotton wadding, or cerate, may be placed over it after the serum has been allowed to escape. To maintain the discharge, the cuticle should be removed and basilicon ointment applied; if the surface requires further irritation, the ointments of savin, mezereon, or cantharides may be used. The open or perpetual blister is, however, not required for ordinary antiphlogistic purposes; and, indeed, as a general rule, the blistered surface should be allowed to heal as soon as possible. In case of excessive pain, a poultice of bread-crumb and lead-water, with one fourth of a grain of morphinæ sulphas mixed in it, or a starch poultice, or lime-water and linseed-oil, make soothing applications. Cosmoline (*ungt. petrolei*) is a suitable application. Goulard's cerate and the benzoated oxide-of-zinc ointment are excellent applications to heal obstinate ulcers from blisters. For the relief of *strangury*, diluents and diuretics are proper, as flaxseed-tea with sweet spirits of nitre. Morphine in aqua camphoræ may also be given, or suppositories of opium and belladonna (per rectum) may be employed. "In maniacs, in the delirious sick, in children, and in other unruly patients, it is often necessary to put on a blister in such a way that the patient has no control over it. For this purpose the cantharidal collodion may be used." This is the flexible collodion, impregnated with cantharides. It furnishes a very convenient mode of blistering a small, irregular surface, and is applied, by means of a camel's-hair brush, in successive layers, which should be covered with oil-silk. The preparation known as Nichol's *acetic cantharidal vesicant* is also used in the same way. Pieces of blotting-paper saturated with this preparation will produce vesication quite speedily. When there is any especial danger to be feared from the absorption of the active principle from any of the foregoing preparations, the use of the poultice may be resorted to as soon as their action has extended beyond rubefaction.

The *stronger water of ammonia* may be used for the purpose of speedy vesication. It is more rapid, but more painful, than cantharides. Five parts of this, mixed with spirit of camphor (two parts) and spirit of rosemary (one part), has been used as a prompt vesicant, under the name of *Granville's lotion*. A piece of flannel, saturated with the liniment, is applied to the skin, which will generally blister in from three to ten minutes. *Gondret's vesicating ointment* is made by melting together two parts of expressed oil of almond and thirty-two parts of lard, and adding to this mixture seventeen parts of stronger water of ammonia; it will vesicate in ten minutes. Ammonia is applied locally as an antidote to the poison of venomous reptiles and insects.

Under the head of *suppurants* the chief agents employed are croton-oil and tartar emetic.

Oleum tiglii, when rubbed on the skin, produces rubefaction, accompanied by a pustular eruption. It is used as an application to the throat and chest in subacute or chronic laryngeal and bronchial affections, and to rheumatic joints. It may be applied undiluted, or mixed with one to three parts of olive-oil or oil of turpentine, according to the susceptibility of the skin.

Unguentum antimonii (antimonial ointment) consists of one part of antimonii et potass. tartras, mixed with four parts of lard. Applied to the

skin, it produces an eruption of pustules resembling those of variola. It may be used in the form of the ointment or in solution, and on plasters in the same cases as croton-oil; but it is a more painful and permanent application, it is rarely needed, and is in many cases injurious.

Escharotics, called also *cauterants*, are those agents which destroy the structure and vitality of the parts to which they are applied. The *eschar* which their application produces is followed by inflammation and suppuration of the surrounding tissues by which the slough is separated from the living parts. They are employed: 1. To effect the destruction of morbid growths, warts, condylomata, polypi, fungous granulations, etc. 2. To decompose the virus of rabid and venomous animals, and of chancres and malignant pustules, and to prevent their absorption. 3. For the cure of violent inflammation by their *substitutive* action, as when they are applied to the mucous or cutaneous surfaces in gonorrhœal ophthalmia, erysipelas, poisoned parts, carbuncles, etc. 4. To stimulate indolent sinuses, ulcers, etc., when their influence is also of a *substitutive* character. 5. To open abscesses; though, for the opening of abscesses of internal viscera, as of the liver, the method of *aspiration* is to be preferred. 6. To form issues. 7. To remove morbid growths, as lupus, cancer, etc.

Perhaps the most commonly employed agent of this division of topical remedies is *argenti nitras* (nitrate of silver). It has the advantage of not liquefying when applied, and its action is therefore confined to the parts with which it is brought in contact, and is superficial. Its power of coagulating albumen when used in full strength causes the parts to be coated over with a white, almost membranous film, which prevents the penetration of the salt into the deeper tissues. For this reason it is useless whenever it is desirable to produce a deep eschar. As a *caustic*, it is applied in the solid form to many *ulcerated surfaces* for the purpose of destroying superficially diseased tissue, and substituting, when the eschar separates, a healthy for an unhealthy action. A solution of forty grains to the ounce may be looked upon as caustic to the mucous membranes, and should only be used as such.

Caustic potassa is the most powerful known escharotic, and differs from lunar caustic in extending its action to a considerable depth beneath the surface to which it is applied. It is used chiefly to form issues to destroy the virus of malignant pustules and that from the bite of venomous reptiles and rabid animals, and sometimes to arrest the sloughing of carbuncles; and, from its deep-reaching action, applied to the cutaneous surface in cases of phlegmon or threatened carbuncle, it will sometimes avert the progress of inflammation. For such purposes it is to be preferred to nitrate of silver. It is a good application in cases of rodent ulcer, the superficial forms of epithelioma generally, and in lupus, the diseased tissue having been removed with the knife as thoroughly as possible previous to the application of the caustic. When applied to the skin, this should be covered with linen spread with adhesive plaster, having a hole the size of the spot to be cauterized.

Potassa cum calce is prepared by rubbing up equal parts of potassa and lime. It is sometimes made into a paste with a little alcohol, and is termed *Vienna paste*. It has also been formed into sticks. The presence of lime renders this a milder, less deliquescent, and more manageable caustic than potassa; it is a favorite application to chancres.

Caustic soda, like caustic potassa, is prepared by the rapid evaporation of its solution with heat. It is employed for the same cauterant purposes as potassa, though it is sometimes milder in action. *London paste* is made by rubbing up equal parts of soda and lime.

Chromic acid is an escharotic of great power, decomposing the tissues by its rapid oxidizing action. Used in the melted or more or less diluted form, it is a most efficacious application to lupus, morbid growths, and excrescences, such as syphilitic condylomata. It gives less pain than other caustics, but it is to be used with caution, especially near delicate parts like the eye, as its action is deeply penetrating. It may be dissolved in its equal weight of water, but the strength of the solution for ordinary purposes is one hundred

grains to the fluidounce of water, and is applied by means of a pencil or glass rod. A solution of six grains to the ounce of water may be used as an intra-uterine injection in chronic hæmorrhage from this organ dependent upon a polypoid condition of its mucous membrane.

Arsenious acid is an active escharotic, and is occasionally applied in lupus, onychia maligna, cancerous ulcers, and to change the action of indolent sinuses; but its use is attended with danger. When it is used, it should be applied freely, as a large amount causes such rapid death of the tissues that absorption is rendered impossible. It may be diluted with one or more parts of sulphur. *Sir Astley Cooper's arsenious ointment* consists of one drachm each of arsenious acid and sulphur to one ounce of spermaceti cerate, which is allowed to remain in contact with the morbid growth for twenty-four hours. Under *no* circumstances should arsenic be applied to a large, healthy surface, such as that of a fresh wound, as its absorption would take place much more rapidly than in an intensely inflamed or dead tissue.

Zinc chloride is also a powerful escharotic, and, in addition to its corrosive properties, it appears to exercise a greater influence over the vital action of neighboring parts than some of the other caustics. The separation of its eschar leaves very healthy and vigorous granulations, and it is one of the best applications that can be made to intractable, indolent ulcers and sinuses. It will cure lupus. "When applied in a concentrated form, it produces intense pain, lasting for six or eight hours, and a whitish eschar, which usually separates in from six to eight days. Its penetrating powers are less than those of caustic potash, and its action is much less rapid and diffusive. It is a superior caustic because its action is more readily controlled than that of potash, because its absorption does not endanger life as is the case with arsenious acid, and because it leaves a slough which is free from odor."

Canquoin's paste is made by mixing the chloride of zinc with flour and water. The strength varies according to the purpose, the weakest being one part of the caustic in six, and the strongest one part in three. When used, a few drops of water are added to form a paste, which is applied in layers, successive applications being required when a large tumor is to be destroyed. The action of chloride of zinc upon the skin is slow, and painful for this reason. Whenever the cuticle over the part to be destroyed is sound, it should be removed by means of blisters. By some surgeons the escharotic is introduced directly into the tumor to be destroyed, pointed strips or arrows being cut from the *stronger paste* referred to, and allowed to dry. Then incisions are made with a bistoury, and these hardened bodies are thrust into the body of the tumor in such a way as to form a slough at its base or from its center. Concentrated alcoholic or watery solutions of chloride of zinc are often used as caustics in cases of *chancres* and other small *specific ulcers*, and as such are very efficient. The application is sometimes made with small pledgets of lint.

The *liquor hydrargyri nitratis*, or *acid* nitrate of mercury, is a valuable caustic application to *malignant* and *specific ulcers*. It is especially useful in *chancres*, to which it should be applied with a glass rod. In forming carbuncle, a drop applied to the center of the unbroken skin appears to concentrate the inflammation, and establishes relief by inducing a free suppuration. It has been largely employed by gynæcologists in *ulcerations of the cervix uteri*. Its action in all these cases is very prompt, and is moderately deep; the pain is severe but transient.

"*Nitric acid* is a powerful caustic, which is never employed to destroy large growths, but it is a favorite application to *chancres*, to *syphilitic*, *phagedenic*, and other unhealthy *ulcers*, as well as to condylomata and other small dermal growths. It is applied by means of a glass rod or splinter of wood. A drop or two is usually amply sufficient, and, when the action has gone far enough, the part should be washed with soap-suds, which at once arrests action and causes the severe pain to cease." It may sometimes be employed to reach the bottoms of sinuses and fistulæ which are inaccessible to

the solid caustics. Nitric acid, for this purpose, has no equal in the list of escharotics.

Bromine is a most efficient escharotic, as, when brought in contact with organic matter, it oxidizes and completely destroys it with great rapidity. "On account of its liquid form, and of this property, bromine is one of the most severe, thorough, and rapid of all the caustics. It has not been much employed to destroy morbid growths, but during our late war this agent was found to be the most efficient of all the applications tried in *hospital gangrene*. After most of the slough had been cut away, the caustic was applied pretty freely by means of a sponge mop or glass rod." The pain was very severe, and usually required anæsthesia, but generally ceased in a short time after the caustic was washed off, or a poultice of linseed-meal was applied.

In considering the subject of escharotics, it may be well to state that the usual rule, with most surgeons, is to regard the knife as the only remedy worth serious attention in case of malignant growths. But there are unquestionably several common forms of semi-malignant new formations capable of detroying life if allowed to progress, but which are curable by proper remedial measures other than the knife. "It is upon these that the quack 'cancer doctor' builds his fame, and it is owing to the indifference of surgical teachers to their medical treatment that he gets a chance to do so. Then there are cases of undoubtedly true malignant tumors which, under the use of caustics and internal medication, have disappeared never to return. In fact, it may be laid down as almost a positive result of surgical experience that a cancer extirpated by the knife returns sooner than one removed by caustics. The suppuration attendant upon the latter seems to remove the remaining cancer-cells, while incision leaves them to set up anew their destructive proliferation." And, in cases where cancerous growths are removed by the knife, the return of the disease is perhaps due to the remains of its germs on its cut surface, to destroy which the surgeon would do well to freely wash the surface of the wound, after operating, with a strong solution of zinc chloride (forty grains to f℥j). In the use of *potassa cum calce* its action may be rendered nearly painless, or entirely so, by mixing one part of morphinæ hydrochloras with three of the caustic, and then, by the addition of chloroform, forming a paste that may be spread upon lead plasters and so applied. In five minutes the skin under the application becomes of a dead white color, and at the end of fifteen minutes is brown and carbonized. If the application be persisted in, the thickness of the eschar becomes finally about equal to that of the layer of the paste employed. There are cases of malignant growths in which surgical interference is out of place. In some localities this is next to impossible, and, should there be any distinct signs of the cancerous diathesis, a resort to the knife would be useless. Then the pain of cancer is often a most distressing and prominent symptom, demanding the most active measures to relieve it. All these considerations should give to the therapeusis of malignant growths a more prominent position than has hitherto been awarded. And especially is this true since the treatment of these morbid growths has been relegated almost entirely to surgeons, the result being that, in the systematic treatises upon this branch of medicine, very little is said about the judicious employment of local curative applications or internal remedies, and what is said is often in condemnation of them as useless, if not pernicious. As a consequence, patients have sought relief among charlatans; and our profession, in this country at least, has been placed in an unfavorable position by now and then meeting with well-attested cures of cancer by measures that it had openly condemned.

Class V.—Disinfectants.

Disinfectants are substances which have been employed for the purpose of destroying noxious miasmata or effluvia. There can be no doubt that *pure air and water are the great disinfectants*, and that the most skillful use of chemical substances can not take the place of *ventilation* and *cleanli-*

ses. Various classifications have been made of substances used as disinfectants, but, for convenience of description, they may be considered under the head of oxidizing agents, desulphurating substances, antiseptic materials, and absorbing substances.

Oxidizing Disinfectants.—"Probably the only absolutely trustworthy disinfectant would be one capable of completely oxidizing and destroying organic matter. Fire is of this character, and, when ruthlessly applied, is certainly absolutely efficacious; but it is evident that the use of this agency must be limited."

Potassii permanganas is a salt whose disinfectant power is unquestioned, but at the same time its power is very limited, as the remedy acts only by yielding up its oxygen, and, being expensive, it is not available to disinfect large masses of materials. It is at present almost solely employed as an addition to water with which foul excreting ulcers and abscesses are washed. It certainly arrests decomposition and destroys its products when used upon diseased surfaces. As a *disinfectant* and *deodorizer*, a solution of from one to ten grains to an ounce of water may be exposed in saucers, or sprinkled on the floor, or thrown into the air in spray by the atomizer, and a solution of similar strength may be employed as a gargle in *diphtheria*, or as a wash in *ozæna* and in fetid *leucorrhœa*.

Solution of chlorinated soda (*Labarraque's disinfectant liquid*) has been used *internally* in malignant scarlatina: dose, thirty drops to a teaspoonful, several times a day, *well diluted*. It is useful also, in solution of various strengths, as an *external* application in any form of fetid ulcer, and is a most powerful and valuable disinfectant.

Bromine and *iodine* are both capable of acting as disinfectants by dehydrogenating water and liberating nascent oxygen. They are less readily applied than chlorine, and are rarely used, especially as they are very costly substances.

Desulphurating disinfectants are various metallic salts which are believed to act as disinfectants by uniting with the sulphur of sulphureted gases, and precipitating as sulphurets. As examples of such may be mentioned sulphate of zinc, sulphate of iron, and nitrate of lead.

Ledoyen's disinfectant solution is a solution of nitrate of lead, and has been and is still used to a considerable extent as a disinfectant. It certainly destroys sulphureted hydrogen with great rapidity; but the objections to its use for the purposes to which it is applied are that it has no action besides that of a desulphurating body, its comparatively high price, and because it forms an intensely black precipitate, discoloring everything with which it comes in contact. Perhaps the most economical as well as efficient agent for the purpose of averting the results of decomposition is *copperas*, or the impure form of *sulphate of iron*. The cheapness, as well as efficiency, of this substance should give it the preference as a disinfectant for use in cess-pools, sewers, and similar positions.

Antiseptic materials are used for the purpose of preventing decomposition when it is desired to preserve organic bodies, such as cadavers. For many years some have believed that fermentation of any sort, whether alcoholic, acetic, or putrefactive, is due to the action of living organisms upon the material undergoing change; but more recently it has been asserted that the chemical alterations are not really produced by these forms, but that the organisms are rather the products of the chemical alterations. With those who advocate the "*germ theory*" the most important use of substances of the present class is to kill disease-germs, whether these be, as some believe, distinct organisms, or merely detached particles of human germinal matter. But, as all of them are probably more poisonous to the higher forms of animal life than to the infusoriæ and their congeners, it is evident that their employment for the purpose of destroying the life of the living particles which constitute contagion (?), especially if within the living body, must be very limited, if not altogether impracticable. The chief antiseptic agents are sulphurous, carbolic, and salicylic acids.

Sulphurous acid and its salts are most efficient in antagonizing the process of putrefaction and fermentation, and, for this reason, are excellent preservatives of organic matters. "Owing to the ease and cheapness with which it is formed, and its great volatility, sulphurous acid is probably the best agent for disinfecting close apartments. Aside from free ventilation, it often seems necessary to disinfect the walls, furniture, etc., of a chamber in which a person has passed through a contagious illness. When this is done, the following method may be adopted. When it is carried into effect, of course the room should be made as tight as possible; the chimney-places, ventilators, windows, and doors of exit being closed, while all the drawers of furniture and the doors of closets are widely opened. Then, on some bricks in the middle of the room, place an iron pot or kettle; into this put a few tablespoonfuls of flowers of sulphur, which should now be thoroughly saturated with alcohol or turpentine, and then ignited. When this is accomplished, the room should be immediately vacated, and the door closed. Unless the apartment becomes densely filled with the fumes, far beyond what could be supported by a human being, the attempt at disinfection can not be of any service. The rooms should be kept shut up until the sulphurous acid can penetrate every crack and crevice of the apartment and finally disperses. Very often it may be well to repeat the process once or twice, and afterward to leave the apartment as open and exposed to the air as possible for some days." Sulphurous acid may be used in saturated solution to disinfect the excretions of the sick. Its bleaching action upon vegetable colors of course unfits it for many uses. The sulphites and the bisulphites are largely employed to arrest or control fermentation in various processes of the arts.

Carbolic acid, in solution of the strength of five per cent (or 1 in 20), is the only one fit for use in disinfection. Though carbolic-acid vapor appears impotent, as regards effect upon contagium, it will preserve the freshness of a bit of meat suspended in it for months. Very small quantities of the liquid acid, mixed with organic fluids, enable them to remain fresh and resist decay for a long time. So little as one fifth per cent preserves milk. For these reasons Dr. Russell, of Glasgow, believes that small quantities of this disinfectant, instead of destroying contagium, may actually preserve its activity when otherwise it would have succumbed to the action of natural agencies, and that this action may accompany the limited use of any disinfectant that has a "pickling" or preservative action in small quantity. This has been proved experimentally by Dr. Dougall, of Glasgow, who found that vaccine mixed with carbolic acid (1 in 50) *regained* its infective power after ten days' exposure to the air. Carbolic acid coagulates albumen when in sufficiently strong solution, while it restrains putrefaction, and hence limits the growth of low forms of animal life. Though it does not destroy sulphureted hydrogen, it is a good deodorant in some cases. Experimenting on a large scale with different substances for removing the odor from the hands of students after working in a dissecting-room has proved that a one-per-cent solution of carbolic acid is superior in efficacy to permanganate of potash, even when strong enough to stain the skin, and that it is also preferable to chloride of lime. In this connection it is worthy of remark that the "septic ferment" or *zymotic action* connected with septicæmia, erysipelas, etc., appears to be destroyed or arrested by rather less carbolic acid than vaccine requires.

Salicylic acid is now widely employed in the place of carbolic acid, and the testimony in its favor seems universal. "Unlike carbolic acid, it is scarcely irritant, much less caustic. In antiseptic surgery it is considered superior to its predecessor in all except a few special cases. Sprinkled upon foul ulcers, it deprives them of odor, but in *phagedæna*, and especially in *infecting wounds*, it is not so serviceable as carbolic acid, probably from the absence of caustic properties." Cotton batting for surgical dressing, and jute for that of suppurating wounds, is now much employed, containing from three to ten per cent of this acid. A solution of 1 part to 300 of water may be used for the antiseptic carbolic-acid dressing; the stronger solution, with sodium phosphate (1 part of the acid, 3 of the soda, to 50 of water), is used to wash or

spray foul surfaces, or as an application to diphtheria. A solution of 1 gr. to ℥j of water is a good injection in gonorrhœa. An efficient ointment may be prepared by dissolving one and a half parts of the acid in two parts of alcohol, and adding lard or cosmoline, or the solubility of the drug in glycerine may be taken advantage of.

Absorbing disinfectants are those substances which are used to act by absorbing the products of decomposition—as, for example, dry earth, charcoal, lime, or plaster-of-Paris. "All of these, when used in sufficient quantity, are very efficient in preventing the escape of foul gases, but are not to be relied upon in cases of contagions. If properly employed, they often not merely absorb the products of decomposition, but also, by removing the moisture, check the decay. For this purpose they should, of course, be very dry when used." When spread upon the walls in the form of whitewash, lime may act to some extent as an oxidizer, but its chief influence is as an absorbent which takes up the deleterious emanations. A very striking illustration of this action of whitewash is said to have occurred some years ago in the New York City Hospital. A ward which stood isolated from the remainder of the institution had been used for the reception of cases of typhus fever from the shipping of the port. It was finally abandoned and allowed to stand unoccupied, with its windows wide open, for several months. At the end of this time a gang of men was set to scraping the whitewash off the walls. Of these workmen a majority were seized with the ship fever, and several of them died.

In conclusion, the following suggestions are applicable as to the modes of carrying out disinfection under circumstances in which it is commonly required: The *clothing* or *bedding* of those with infectious disease, if not burned, may be subjected to high temperature (baked) in a closed oven, or well boiled with soda; but, as soon as removed from the patient, and before coming to the wash-house, they should be steeped in a five-per-cent solution of carbolic acid, or chloride of zinc (1 to 240), or chloride of lime (two ounces to the gallon).

Rooms should be thoroughly cleaned with soap and hot water containing carbolic acid (five per cent)—walls and ceiling brushed and wall-paper removed, and the apartment fumigated with sulphur after the manner described. The usual rule is to use one pound of sulphur for each one thousand cubic feet of space. The excreta from cases of infectious diseases, such as cholera and typhoid fever, require a very large quantity of disinfectant, which should be applied in a concentrated form before they are thrown into the water-closets or privy-vaults. They should first be received in a vessel containing half a pint or more of a one-in-twenty solution of commercial hydrochloric or sulphuric acid, and then put, along with some chloride of lime, into a covered stone-ware vessel in the back yard for a few hours before the contents of the vessel are finally disposed of.

Dead bodies, if putrid or bearing contagium, should be wrapped in sheets wet with a one-in-twenty carbolic solution, or one-in-forty chloride of lime, or, if coffined, saw-dust saturated with one of these solutions should be packed around them. It is necessary always to keep clearly in view the difference in the action of disinfectants, according to the object desired when selecting these agents, whether this be destruction of contagium or decomposition of its material, merely "pickling" and preserving, arresting putrefaction, and fermentation or deodorization. From what has been stated, it is evident that the different "disinfecting" nostrums with which the country is flooded, applied as their inventors direct, can have but little effect upon contagium, but may have more or less influence in other directions indicated.

Class VI.—Demulcents.

These are bland substances, which form, more or less, gummy or mucilaginous solutions in water, and, when applied to irritated or inflamed surfaces they are capable of softening and relaxing tissues, and so diminish heat ten

sion and pain. They consist chiefly of gum or mucilage, or a mixture of these with saccharine and farinaceous substances. Their constitutional effe are principally nutritive, though perhaps, to some extent, they relieve irrita tion in distant organs; but this is perhaps mainly, if not altogether, due the large quantities of water with which they are administered, thus ent ing the circulation, and, passing through the body, lessening the concent tion, and hence the acridity of the urine and other excretions.

Uses.—Demulcent solutions are administered internally: 1. To shea and protect the gastro-enteric surface from the injurious effects of irrita substances, particularly acrid poisons. 2. To relieve irritation and infla mation of the alimentary canal, as in gastritis, enteritis, diarrhœa, and dys tery, and for this purpose they may be administered by either the mouth the rectum. 3. In catarrhal affections, in which they are probably useful part by the transmission of their lubricating and soothing effects on fauces and œsophagus, by reflex action to the laryngeal and bronchial m branes, and in part by modifying the acridity of expectorated matters. In affections of the urinary passages, as ardor urinæ, cystitis, etc., and in th cases they act chiefly by diminishing the acridity of the excretions. As agreeable drinks to quench thirst, and promote the action of the secret and exhaling organs in febrile affections. Their effects in these cases owing to the water they contain, to which they are added merely for sake of flavor, and partly also to the nutriment which they furnish. Wh administered with the object of increasing the proportion of the fluid parts the blood, demulcents are termed *diluents.* 6. As light diet for the sick. For pharmaceutical purposes, to suspend substances insoluble in water.

Externally, mucilaginous solutions are employed extensively to relieve heat, swelling, and pain of inflammation, wounds, burns, etc.; to hasten su puration where inflammation is too far advanced for resolution; to cleanse f and scabby ulcers; to promote suppuration from granulated surfaces, etc. M cilaginous and amylaceous substances are applied to inflamed and ulcera parts, mixed with water, so as to form soft masses termed *cataplasms*, or *pou tices.* These are useful vehicles of heat and moisture of the skin, and are use also, as local applications in rheumatism and gout, and for the relief of inter nal inflammation, as when applied to the chest and abdomen in pleurisy, bronchitis, peritonitis, dysentery, etc. Applied to raw surfaces, they exert a soothing influence by excluding air. Applied over deep-seated inflammations, they perhaps do good by causing a dilation of the cutaneous blood-vessels and so diminishing the internal congestion. When any of the present class of agents are applied externally, they are termed *emollients.*

Gum-arabic is extensively employed internally as a demulcent and as a diluent in fevers and inflammatory cases. It is no longer regarded as nutritive. It is usually administered in solution (℥j to boiling water Oj, to be given when cool). The *syrupus acaciæ* (twenty-five per cent of mucilage of acacia mixed with seventy-five per cent of syrup) is used in making emulsions. By dissolving equal parts of sugar and gum-arabic in water and evaporating, an agreeable demulcent is obtained, known as *gum-pectoral*, which is sold as an imitation of *jujube-paste. Mistura amygdalæ* (*almond mixture*) is made by dissolving a mixture of six parts of *blanched* sweet almonds, one part of gum-arabic, and three of sugar, in one hundred parts of distilled water. It is a pleasant demulcent, and a vehicle for other medicines.

Slippery-elm bark is a valuable demulcent, extensively employed in dysentery, diarrhœa, genito-urinary diseases, catarrh, etc. The infusion—*mucilago ulmi* (mucilage of slippery-elm bark) (℥iss to boiling water Oj)—may be used *ad libitum.* It is regarded as highly nutritive.

Quince-seed in solution (*mucilago cydonii*), two drachms to a pint of boiling water, is a suitable external application of demulcent properties, and makes a good vehicle for medicines to be applied to inflamed mucous surfaces.

Refined liquorice (*extractum glycyrrhizæ purum*) is a pleasant demulcent much used as an addition to cough-mixtures. *Mistura glycyrrhizæ composita*

compound mixture of liquorice), commonly called *brown mixture*, consists of pure liquorice, gum-arabic, sugar, each half a Troy ounce; paregoric, f ʒ ij; antimonial wine, f ʒ j; sweet spirit of niter, f ʒ ss.; water, f ʒ xii. Dose, f ʒ ss.

Chondrus crispus (Irish moss) is a very agreeable nutritive demulcent, useful in bowel complaints and pectoral affections. It may be given in the form of *decoction* (half a Troy ounce to water Ojss. boiled to Oj), flavored with lemon-juice and sugar, or it may be made, with milk or cream, into *blanc mange*, which forms an excellent light diet for the sick. By saturating two superimposed layers of wadding with a solution of chondrus and drying them in a stove, after they have been submitted to strong pressure, a sheet of the consistence of card-board is produced, which, when soaked in hot water, makes an excellent poultice.

Amylum.—The starchy or farinaceous articles form an important group of nutrients, being converted into grape-sugar by intestinal digestion. It is used externally as a dusting-powder to excoriated surfaces, as an emollient poultice, and, in solution, as a vehicle for laudanum as an enema.

Glyceritum amyli (glycerite of starch) contains ten per cent of starch, thoroughly mixed with glycerine and dissolved by the aid of heat. "It is an excellent vehicle for astringent applications, and to allay the heat, burning, and itching of the skin in scarlatina and small-pox; in the latter it is pleasant to the patient, and has as much effect in preventing pitting as any other application." (Morris.) It is used as a substitute for ointments, and is a good excipient for pills.

Maranta (arrowroot) affords the most readily prepared and, in the sick-room, the most popular of all the farinaceous articles of diet. It may be prepared in the following manner: Stir two teaspoonfuls of arrowroot in half a teacupful of cold milk until a *perfectly smooth* mixture is made; have on the fire a pint of milk, and while this is boiling add the arrowroot, little by little, stirring constantly until cooked—i. e., from one to two minutes after the last is poured in. Add sugar, nutmeg, and wine, according to taste or the exigencies of the case. When milk is not to be had, or a very low diet is required, water may be substituted.

Class VII.—Emollients.

For *external* use, many oleaginous substances are used as emollients, such as lard, suet, spermaceti, glycerine, cacao-butter, and petrolatum. The last three articles are especially valuable, as they are bland, unirritating, and do not become rancid. Glycerine has the capacity of diffusing itself freely over and through organic matter, incorporating itself between organic molecules, by which it is absorbed and appropriated, and it is as a topical application that it is chiefly employed. It may be used as an enema in dysentery, and to soften hardened mucus in the air-passages. As a topical application in various cutaneous affections—in diphtheria, in deafness attended with dryness of the meatus, and as a vehicle or solvent for active medicines designed for cutaneous absorption—glycerine is a valuable article. *Cacao-butter* is largely used in preparing suppositories, for which it is well adapted from its consistence and blandness.

Petrolatum has been introduced into the Pharmacopœia as a substitute for vaseline, cosmoline, and other copyrighted preparations; it consists of mixtures of *paraffine* and the heavier petroleum oils, and, like them, possesses the advantage over the animal oils and fats of not becoming rancid. It is principally used externally, as an unguent in scarlet fever and cutaneous affections, and forms an admirable basis for other ointments. It is an excellent dressing for wounds.

Under the head of emollients we may, in conclusion, speak of poultices, which are moist, soft, scarcely adhesive, perfectly bland plasters, used to a very great extent to combat superficial inflammation. "Poultices are much more powerful agents than the true fatty emollients, and are much more capable of being abused. A poultice may, of course, be stimulating and

irritant if made of such a substance as mustard, but the ordinary poultice is prepared from material which is totally free from action upon the skin. There seems to be no difference in the action of the various substances usually employed in the preparation of poultices, as they all depend for their remedial powers solely upon the warmth and water which they contain. Water, when pure and of a temperature approximating that of the body, is a sedative, checking all action possibly by direct influence, but probably by the merely mechanical acts of dilution of the pabulum and of separation of the germinal granules. It is also a relaxant, rendering all tissues soaked in it soft and yielding. Poultices are sometimes applied, in the early stages of phlegmonous and other superficial inflammations, for the purpose of checking the morbid action. Their influence is in such cases simply that of sedation, and are certainly not so efficient as the cold-water dressing. They are, however, especially useful in the advanced stages of inflammation, when suppuration has already commenced, or is about to set in. Clinical experience has demonstrated that they now favor the formation of pus. If, as Cohnheim believes, pus is composed solely or largely of out-wandering white-blood corpuscles, it is evident that the relaxing influence of a warm poultice would greatly facilitate the escape of these bodies. Further, the poultice in the latter stages of a superficial phlegmon not only hastens the formation of pus in the inflammatory focus, but lessens irritation in the outlying parts by its sedative action, and so softens the tissues to aid in the passage outward and the discharge of the inflammatory products. When poulticing is too long persisted in, the part becomes pale or white, swollen, relaxed, and has a sodden look. The granulations of the ulcer or abscess are pale and very flabby, and all the vital actions are below the normal point. It is possible that even death of a part might be brought about by continuous poulticing. Be this as it may, after the discharge of pus, whenever the parts put on the aspect spoken of, the poultice should be removed and stimulating applications substituted." Clinical experience has also demonstrated the value of poultices in other than superficial inflammation. They are usefully employed, even when so deep-seated tissues as the lungs are affected. "Their action in these cases is somewhat different from that which they exercise over superficial inflammations. According to the dictates of experience, they should be applied very hot, and frequently renewed; very often, too, a small amount of mustard, or some similar stimulating material, is added to them with advantage. As a result, these poultices act as gentle, but deep-reaching counter-irritants, which, in all likelihood, affect, not merely the blood-vessels of the skin and subdermal tissue, but a derivative influence upon the circulation in the deep-seated structures. When it is borne in mind that in all these cases the poultice is applied to a very large surface, it will be readily perceived that this counter-irritation is a powerful one. Thus, in *pleurisy* or in *pneumonia*, the whole anterior or posterior surface of the chest is covered, or perhaps the whole chest is enveloped by the jacket-poultice. In *peritonitis* the poultice should be as large as the abdomen of the patient. In either of the cases mentioned it is very evident that the amount of blood drawn to the surface must be considerable."

Flaxseed-meal is the most frequently used substance for making poultices, for which purpose the large amounts of oil and mucilage which it contains especially fit it. Ground *slippery-elm* makes a very elegant demulcent, mucilaginous poultice. Ordinary mush from *Indian-meal* affords a cheap and very serviceable material, and *bread and milk* makes a popular, very mild, and unirritating poultice. "When a poultice is to be applied to affect internal organs, and consequently has to be large and capable of holding the heat and moisture for a long time, the choice of material lies exclusively between flaxseed and Indian-meal. The former of these is the more adhesive, and makes the more manageable poultice; but popular belief, and perhaps with reason, attributes to mush a superior power of retaining heat. In either case, the poultice should be put on as hot as it can be borne, and should be covered with a large piece of silk oil-cloth, which aids in retaining not only the moisture, but also the heat. The interval of renewal

should be short, and should be governed solely by the rapidity with which the applied poultice grows cold." (Wood.) Flaxseed-meal poultices are best made from meal from which the oil has been expressed, as the pure meal becomes rapidly rancid. The "British Pharmacopœia" recommends the addition of a little olive-oil. The following is a useful method of making a linseed-meal poultice: Heat the basin in which the poultice is to be made with boiling water; then empty it and put into it again as much boiling water as may be necessary to make the required poultice; sprinkle the meal into the water, stirring vigorously till the proper consistence is obtained; lastly, stir in a small quantity of olive-oil. By adopting this plan, the poultice will be free from lumps. The poultice should then be spread with a broad spatula (or case-knife) on a piece of rag. It must be of uniform thickness, and neither so thick as to be too heavy, nor so thin as to cool and dry too rapidly. As a rule, a poultice may be changed every two or three hours by day, and every four hours at night if the patient is sleeping. In all cases where there is free suppuration, a poultice is the dirtiest application that can be made to the wound. Wet boracic acid lint, or carded oakum, should always be used instead. If carded oakum be used, it must be made into a soft and even pad, and may be dipped in hot water before being applied. It is a most powerful antiseptic, and very cheap; but it has the disadvantage of blacking the skin with the tar it contains, and sometimes causes considerable irritation. Both these inconveniences may be overcome to a certain extent by greasing the skin with cosmoline or carbolic oil (one to ten). The objections to ordinary poultices are that they are somewhat troublesome; they soon become cold and hard, and, if the patient be restless, their weight causes them to shift, and fragments break off and drop into the bed, and there drying, cause considerable discomfort. For application to external inflammations, a few folds of lint soaked in hot water or any appropriate lotion (sedative, stimulant, or antiseptic), covered with oil-silk and afterward with a thick layer of cotton-wool, will be found to answer, in most instances, every purpose of a poultice, and to be much more cleanly and less troublesome. This application is also serviceable for internal inflammation. If any counter-irritant action is required, a few drops of chloroform or turpentine may be sprinkled on cotton-wool covered with oil-silk and secured by a bandage.

The ordinary counter-irritant poultice (*cataplasma sinapis*) is composed of mustard in powder and linseed-meal, of each two and a half parts, and boiling water ten parts. The linseed-meal is to be mixed with the water and the mustard added, constantly stirring. When applied, it should be remembered that mustard varies in strength, and its action should only extend to producing redness of the skin. Should it be kept on too long, it will cause vesication, and has even been known to give rise to sloughing. The time a mustard poultice can be kept on varies from ten minutes to half an hour or more, according to the strength of the mustard and susceptibility of the skin. The guide most usually relied upon is the sensation of the patient. An ordinary patient is not likely to keep it on too long, as the smarting soon becomes unbearable. Patients who are much in the habit of applying mustard poultices to the same part—as, for instance, the front of the chest—acquire a singular power of resistance to the irritative action of the mustard. The mustard poultice is indicated whenever mild and rapid counter-irritation is desired. It is especially useful in bronchitis and in muscular rheumatism, as lumbago or pleurodynia. Oftentimes the *chartæ sinapis* (already referred to) may be applied, covered with a towel wrung out of hot water, as an excellent substitute for the mustard poultice. They are cleaner, more easily applied, and can be more accurately adapted to the spot required, for which reasons they may generally be used in preference when obtainable.

Class VIII.—Protectives.

In this class are included those materials employed by the practitioner as external applications to exclude the air and to protect inflamed dermal or

other tissues. In addition to demulcents and emollients, which act as protectives, there are certain remedies which act more plainly, in a mechanical method, in warding off external agencies. In this way certain plasters are used to protect the skin and raw surfaces from external influences. The *adhesive plaster* (*emplastrum resinæ*) is largely used for mechanical purposes; but, as it is somewhat irritating to the skin, it is rarely employed when protection is the only object. For the latter purpose, the isinglass plaster, or the lead plaster (*emplastrum plumbi*), or the soap plaster (*emplastrum saponis*), are preferable. The two last-mentioned plasters are only slightly adhesive, and, when spread upon soft kid, so as to be pliable, they are very useful to protect the skin from pressure or friction, as when *bed-sores* are threatened.

Collodion is a solution of pyroxylin in ether and alcohol. When applied to the skin, the solvent evaporates and it forms a colorless, transparent, flexible, and strongly contractile film. In this way it proves antiphlogistic by driving the blood away from a part, limiting effusion, and promoting absorption, and at the same time shields an inflamed surface from the action of the air. It is a useful application to ulcers, fissures, and skin diseases, and erysipelatous parts. "Marked improvement has followed its daily use in that disfiguring *Keloid* of the face which sometimes follows small-pox." It is also employed in surgery as a substitute for adhesive plaster in minor operations, care being taken in its application to allow for the discharge of pus. "Small fresh wounds, such as cuts on the fingers and about the head, may be advantageously dressed in the following manner: If necessary, the hair must first be shaved off the part, and then a piece of coarse gauze or mosquito-netting of suitable size and shape should be laid so as to cover the wound and extend across each side from a half to an inch and a half, according to circumstances. One end should then be tightly fastened to the skin by repeated applications of the collodion with a camel's-hair brush. When adhesion has become sufficiently firm, the gauze should be drawn so as to close the wound tightly, and while it is held in position the collodion should be applied all over it. As the collodion contracts during drying, the wound is more and more tightly closed, until at last a firm, perfectly tight dressing binds it close together." Instead of the gauze, strips of isinglass plaster may be used; but, of course, in deep wounds this method of closure, which prevents drainage, should not be used. In pharmacy, collodion is sometimes used as a vehicle for other medicine. "Any principle which is soluble in a mixture of ether and alcohol may be added to collodion, and in this way medicinal substances may be applied to external surfaces. The films formed are often less firm and adhesive than those of simple collodion." *Iodized collodion* (a very good solution of iodine for external application) contains from ten to twenty grains of iodine in a fluidounce of collodion. The contraction of the collodion film is a great drawback to its use for certain purposes. This can be in a great measure obviated and the film made more pliable by the addition of from eight to ten drops of castor-oil to the ounce of the liquid.

Under the name of *flexible collodion* (*collodium flexile*) the United States Pharmacopœia directs a preparation similar to that just mentioned. It is made by mixing 92 per cent of collodion, 5 per cent of Canada turpentine, and 3 per cent of castor-oil. This is a softer, more pliable, and more elastic preparation than simple collodion. It is a good application in eczema.

Collodium stypticum (*styptic collodion*) contains 20 per cent of tannic acid, 5 per cent of alcohol, 20 per cent of stronger ether, and 55 per cent of collodion. It is an excellent styptic application. Collodion in all its forms should be kept in well-stoppered bottles.

Liquor gutta perchæ is a solution of 9 per cent of gutta percha in 91 per cent of purified chloroform. In preparing it, carbonate of lead is employed to free it from coloring-matter. It is a clear or nearly colorless solution, and should be kept in well-stoppered phials. By the evaporation of the chloroform this proves an admirable application to inflamed or abraded parts, in

skin affections, chaps, etc.; also an excellent protective coating to parts threatened with bed-sores or liable to excoriation.

Liquor Sodii Silicatis.—This is commonly known as a solution of soluble glass, and is made by fusing together fine sand and sodium carbonate, and dissolving the product in hot water. It is a semi-transparent, colorless, viscid liquid (without odor, but having a sharp alkaline taste), which, on drying, becomes a transparent, glass-like mass. It has been used as a local application in erysipelas, but is chiefly used in making permanent dressings in the treatment of fractures. For this purpose it should be thoroughly applied to successive layers of the dressing to the part and allowed to harden.

SELECTED MATERIA MEDICA LIST.

In the consideration of the foregoing classes of medicinal agents, our object has been to present only the most important and valuable. In pursuing this course, we have been actuated by the belief that one of the great evils of the profession to-day is the multiplication of medicines.

There are so many medicines, and so many forms of the same medicine, that either a proper classification, comparison, or just conclusion respecting their therapeutic effects is very difficult, and, we may say, almost impracticable. We have scores of articles in our Pharmacopœia and in our text-books of materia medica that are no longer worthy of their position, and ought to be expunged, their effects being uncertain, unreliable, and oftentimes will serve only as stumbling-blocks in practice. Such agents are already superseded by other remedies of tried and known value—by those whose physiological effects are fully explained and verified by clinical experience. Not only ought many old remedies now obsolete in practice to be eliminated from our text-books, but, since the manufacture and sale of new remedies have become an extensive branch of trade, their reputed powers should be received by the practitioner with due caution. We would not be understood, however, from what has been said, that the practitioner should fall into routine methods with a few agents that have to do duty for all possible conditions. It is true that some men, with the aid of a hatchet, a saw, a square, and a chisel, can build a house, while others would fail with the assistance of all the tools in a hardware-store. Yet the skilled and scientific mechanic who engages to construct a building in harmony with the most approved laws of architecture—one designed to give satisfaction to his patrons and reflect credit upon himself—would certainly avail himself of a more extensive collection of implements than those that we have mentioned. And so it is in the practice of medicine: although it is better thoroughly to understand what can be done with a dozen remedies than to have a smattering idea of a thousand, yet the importance of this branch of the healing art justifies a more extensive knowledge on the part of the physician which may facilitate the use of this his "armamentarium" in his battling with all the diversified forms of disease. In the following pages will be found a carefully selected list of therapeutic agents of known value and of sufficient variety to meet almost every conceivable indication for which medicines are prescribed.

A List of the Principal Articles of the Materia Medica, classified according to their Chief Properties, with the Doses for Adults.

The fraction obtained by dividing the age of the child by the age of the child *plus twelve* will give the proportion of the adult dose which should be administered to the child; or the proportionate dose for any age under adult life is represented by the number of the next birthday divided by 24—i. e., for one year, $^2/_{24} = ^1/_{12}$; for two years, $^3/_{24} = ⅛$.

These doses may be approximately reduced to "metric" terms by multiplying grains or minims by 6, which gives centigrammes; drachms by 4, and ounces by 32, which give grammes.

DIVISION I.—ELIMINANTS.

		Dose for an Adult.
Class I.—Emetics:		
1. Irritant.—	Alumén	ʒ 1- 2
	Cupri sulphas	grs. 5-10
	Zinci sulphas	grs. 10-30
	Sodii chloridum	ʒ 2- 4
	Sinapis pulvis	ʒ 2- 4
	Ammonii carbonas	grs. 20-30
2. Specific.—	Antimoniæ et pot. tart	grs. 1- 2
	" " " vinum	℥ ½- 1
	Ipecacuanhæ pulvis	grs. 15-30
	" vinum	℥ ½- 1
	Emetine	gr. ⅛-¼
	Scillæ syrup. comp	℥ ½- 1
	Apomorphinæ hydrochloras	gr. ⅛-1/6
Class II.—Cathartics:		
1. Laxative.—	Confectio sulphuris	ʒ 1- 2
	Ricini oleum	℥ ½- 1
	Olivæ oleum	℥ 1- 2
	Rhei, ext. fld	ʒ ½- 1
	" et senna, ext. fld	ʒ 1- 2
	" syrupus aromaticus	℥ ½- 1
	Confectio sennæ	ʒ 1- 2
	Sennæ ext. fld	ʒ 2- 4
	Cascaræ sagradæ, ext. fld	ʒ ½- 1
2. Cholagogue.—	Aloe purificata	grs. 5-20
	" vinum	ʒ 2- 4
	Hydrarg. chloridum mite	grs. 5-10
	" pilulæ	grs. 5-15
	Leptandræ, ext. fld	ʒ ½- 1
	Leptandrin	grs. 1- 3
	Podophyllin	gr. ⅛-¼
	Taraxaci, ext. fld	ʒ 1- 3
	Iridin	grs. 1- 2
	Euonymin	grs. 1- 3
3. Hydragogue.—	Elaterium (Clutterbuck's)	gr. ⅛-1/6
	Colocynthidis, ext. comp	grs. 5-10
	Gambogia	grs. 2- 6
	Jalapæ extract	grs. 5-10
	" pulv. comp	grs. 15-30
	Tiglii oleum	gtt. 1- 3
	Magnesii sulphas	℥ ½- 1
	Potassii bitartras	℥ ½- 1
	Potassii et sodii tartras	℥ ½- 1
Class III.—Diaphoretics:		
1. Nauseating.—	Antimonii et pot. tart	gr. 1/16-¼
	" " " vinum	♏ 10-30
	Ipecacuanhæ pulvis	gr. ¼- 1
	" " comp	grs. 5-15
	" vinum	♏ 10-30
2. Refrigerant.—	Ammonia acetas liquor	℥ ½- 1
	Potassii citras liquor	℥ ½- 1
	Gelsemii, ext. fld	♏ 5-10
	Aconiti tinctura	gtt. 2- 5
	Veratri viridis tinct	gtt. 2- 8
3. Stimulating.—	Jaborandi, ext. fld	ʒ ½- 1
	Pilocarpinæ hydrochloras	gr. ⅛-¼
	Spiritus etheris nitrosi	ʒ ½- 1

Class IV.—Diuretics:		*Dose for an Adult.*
1. Hydragogue.—	Scillæ pulvis	grs. 1- 2
	" extract	gr. ½- 1
	" ext. fld	♏ 1- 2
	Digitalis pulvis	gr. ½- 1
	" ext. alcoholic	gr. ¼-½
	" " fld	♏ 5-10
	" tinctura	♏ 10-20
	Scoparii, ext. fld	ʒ ¼- 1
	Scoparin	grs. 1- 5
	Spiritus etheris nitrosi	ʒ 1- 4
2. Refrigerant.—	Potassii acetas	grs. 20-60
	" bitartras	grs. 20-60
	" bicarbonas	grs. 10-20
	" chloras	grs. 10-20
	Lithii carbonas	grs. 3- 5
3. Stimulating.—	Buchu, ext. fld	ʒ ½- 1
	Juniperi oleum	♏ 5-10
	" spiritus	ʒ 1- 4
	Terebinthinæ oleum	♏ 5-10
	Copaibæ	♏ 15-20
	" oleum	♏ 5-10
	Cubebæ pulvis	ʒ ½- 3
	" oleum	♏ 5-10
	" oleoresin	♏ 10-15
	Cantharidis tinctura	♏ 3- 5
Class V.—Expectorants:		
1. Nauseant.—	Antimonii et pot. tart	gr. 1/12-¼
	" " " vinum	♏ 5-10
	Ipecacuanhæ pulvis	gr. ¼- 1
	" ext. fld	♏ 1- 2
	" syrupus	ʒ ½- 1
	" vinum	♏ 5-20
	Lobeliæ tinctura	ʒ ½- 1
2. Stimulating.—	Ammonii chloridum	grs. 10-15
	Copaibæ	♏ 10-60
	" oleum	♏ 5-10
	Cubebæ tinct	ʒ 1- 2
	Opii tinct. camph	ʒ 1- 4
	Potassii chloras	grs. 5-15
	" iodidum	grs. 5-10
	Senegæ, ext. fld	♏ 5-15
	" syrupus	ʒ 1- 2
	Scillæ syrupus	ʒ ½- 1
	" " comp	ʒ ¼- 1
	Tolutanus syrupus	ʒ 1- 4
Class VI.—Emmenagogues:		
1. Tonic.—	Ferri mistura comp	℥ ½- 1
	" sulphas exsiccatus	grs. 2- 5
	" et strychninæ citras	grs. 1- 3
	" iodidi syrupus	♏ 20-40
	" amarum vinum	ʒ 1- 2
2. Purgative.—	Aloes socotrina	grs. 2- 5
	" et ferri pil	grs. 5-10
	" et myrrh, tinct	ʒ 1- 2
	Hellebori extractum	grs. 1- 3
	" " fld	♏ 5-10
	" tinctura	♏ 15-60

	Dose for an Adult.
3. Stimulating.—Sabinæ oleum	♏ 3- 5
Rutæ oleum	♏ 2- 5
Tanaceti oleum	♏ 2- 5
Apiol	grs. 2- 3
Guaiaci tinctura ammoniata	ʒ ½- 1
Potassii permanganas	gr. 1- 2
Cantharidis tinctura	♏ 2- 3

DIVISION II.—HÆMATICS.

Order I.—Restoratives:

Class I. Acids.—Acidum aceticum dil.	ʒ ½- 1
" citricum	grs. 10-30
" lacticum	ʒ ¼- 1
" muriaticum dil.	♏ 5-20
" nitricum dil	♏ 5-15
" nitro-muriaticum dil..	♏ 5-15
" sulphuricum dil.	♏ 5-20
" " aromaticum.	♏ 10-20
" phosphoricum dil.	♏ 10-30
Class II. Alkalies.—Potassii liquor	♏ 5-15
" bicarbonas	grs. 5-30
" bitartras	ʒ 1- 4
" chloras	grs. 5-20
" citras	grs. 5-30
Calcii chloridum	grs. 3-15
" hypophosphis	grs. 3-15
" lacto-phosphas	grs. 5-30
" phosphas præc.	grs. 10-30
Sodii bicarbonas	grs. 5-60
" hyposulphis	grs. 3-20
" lacto-phosphas	grs. 3-30
" chloridum	grs. 5-30
Class III. Chalybeates.—Ferrum dialysatum	♏ 5-30
" reductum	grs. 1- 3
" ammoniatum	grs. 5-10
Ferri chloridi tinctura	♏ 5-40
" acetatis tinctura	ʒ ½- 1
" carbonas saccharatus	grs. 5-30
" lactas	grs. 3- 5
" citras	grs. 5-10
" iodidi syrupus	♏ 15-40
" pyrophosphas	grs. 2- 5
" subcarbonas	grs. 5-30
" subsulphatis liquor	♏ 5-10
" sulphas exsiccata	grs. ½- 3
" et ammon. tart.	grs. 10-30
" et pot. tart.	grs. 10-30
" et quininæ citras	grs. 3- 6
" et ammon. acetas mistura.	℥ ½- 1
" bromidi syrupus	ʒ ½- 1

Order II.—Catalytics:

Class I. Alteratives.—Hydrargyri massa	grs. 1- 3
" chloridum mite	grs. ½- 2
" chloridum corrosivum.	gr. 1/16-⅛
" iodidum viride	gr. ¼-½
" " rubrum	gr. 1/16-¼
Iodinii liquor comp.	♏ 5-15
" tinctura comp.	♏ 10-20

		Dose for an Adult.
	Potassii iodidum	grs. 5–15
	Ammonii iodidum	grs. 5–10
	Sodii iodidum	grs. 5–10
	Arsenii iodidum	gr. 1/16–1/8
	Liquor potassii arsenitis	♏ 3– 6
	" sodii arsenitis	♏ 5–10
	" acidi arseniosi	♏ 3– 6
	" arsenii et hydrarg. iodidi	♏ 5–20
	Calcii chloridum	grs. 5–20
Class II. Solvents.—	Potassii bicarbonas	grs. 20–60
	Lithii carbonas	grs. 3– 5
	" citras	grs. 3– 5
	" benzoas	grs. 3– 5
	Acidum phosphoricum dil	♏ 10–30
	" hydrochloricum dil	♏ 5–20
	" nitro-hydrochloricum dil.	♏ 3–15
	" aceticum dil	ʒ 1/2– 1
	" lacticum	♏ 15–60
	" citricum	grs. 10–30

DIVISION III.—NEUROTICS.

Class I.—Analgesics:		
	Opium	grs. 1/2–1 1/2
	" denarcotisatum	grs. 1/2–1 1/2
	Opii extractum	gr. 1/4–3/4
	" tinctura	♏ 5–15
	" " deodorata	♏ 5–15
	" acetum	♏ 5–15
	" vinum	♏ 5–15
	Morphinæ sulphas	gr. 1/6–1/4
	" acetas	gr. 1/6–1/4
	" hydrochloras	gr. 1/6–1/4
	Cannabis Indica ext	grs. 1/2– 2
	" " tinctura	♏ 10–40
Class II.—Hypnotics:		
	Chloralhydrate	grs. 5–20
	Potassii bromidum	grs. 20–60
	Ammonii bromidum	grs. 5–30
	Sodii bromidum	grs. 15–30
	Lithii bromidum	grs. 10–20
	Lactucarium	grs. 5–10
	Luctucarii syrupus	ʒ 2– 4
	Lupulin	grs. 5–10
	Lupulinii, ext. fld	♏ 5–10
	" oleoresin	grs. 2– 5
	Camphora, monobromata	grs. 2– 5
Class III.—Mydriatics:		
	Belladonnæ extractum	gr. 1/4–1/2
	" " fld	♏ 1– 2
	" " tinctura	♏ 5–15
	Atropinæ sulphas	gr. 1/120–1/60
	Hyoscyami extractum	grs. 1– 2
	" " fld	♏ 2–10
	" tinctura	ʒ 1/4– 1
	Hyoscyaminæ sulphas	gr. 1/120–1/60
	Stramonii extractum	gr. 1/8–1/4
	" tinctura	♏ 5–20
	Daturine	gr. 1/60–1/20
	Duboisinæ sulphas	gr. 1/120–1/60
	" murias	gr. 1/120–1/60

Class IV.—Antispasmodics:		*Dose for an Adult.*
1. Stimulating.—	Valerianæ, extract fld.	ʒ ½– 1
	" tinctura.	ʒ 1– 3
	Valerianæ ammon. tinct.	ʒ 1– 2
	Asafœtida.	grs. 6–12
	" tinctura.	♏ ½– 1
	Caffeine.	grs. 1– 2
	" citrate.	grs. 1– 2
	" valerianate.	grs. 1– 2
	Erythroxyli, ext. fld.	ʒ ½– 2
	Guaranæ, ext. fld.	ʒ ½– 1
	Etheris spiritus comp	ʒ 1– 2
	Camphora	grs. 10–15
	Camphoræ spiritus.	ʒ ½– 1
	" aqua	℥ ½– 2
2. Sedative.—	Antimonii et pot. tart.	gr. ¼–½
	" " " vinum	ʒ 2– 4
	Ipecacuanha	grs. 2– 5
	Ipecacuanhæ, ext. fld.	♏ 5–10
	" vinum	ʒ 1– 2
	" syrupus	ʒ 2– 4
	Morphinæ sulphate.	gr. ⅛–¾
	" valerianate	gr. ⅛–¾
	Opium	grs. 1– 3
	Potassii bromidum.	ʒ ½– 1
	Chloralhydrate.	grs. 20–30
	Physostigmatis extractum	gr. ⅛–1/6
	" tinctura	♏ 5–10
	Veratri viridis tinct.	♏ 10–30
Class V.—Antipyretics:		
1. Increasing Heat-Loss.—	Aconiti tinctura.	♏ 2– 5
	Veratrii viride tinctura	♏ 2–10
	Antimonii et potass. tart.	gr. ⅛–½
	Gelsemii, ext. fld.	♏ 5–10
	Ipecacuanhæ et opii pulvis.	grs. 5–10
	" " syrupus.	ʒ 1– 2
	Chloral hydrate.	grs. 20–40
2. Diminishing Heat-Production.—	Quininæ sulphas.	grs. 20–30
	" bisulphas.	grs. 10–20
	" salicylas.	grs. 15–20
	Digitalis tinctura.	♏ 10–20
	Sodii salicylas.	grs. 10–20
	Salicinum.	grs. 15–20
	Kairina	grs. 5–15
Class VI.—Antiperiodics:		
	Acidum arseniosum	gr. 1/24–¼
	Liquor potassii arsenitis	♏ 5–15
	Quininæ sulphas.	grs. 5–10
	Chinoidinum	grs. 10–15
	Eucalypti, extract fld.	ʒ ½– 2
	" oleum.	♏ 2– 5
	Salicinum.	grs. 15–20
	Piperina.	grs. 1– 8
	Apiol	grs. 2– 5
	Caffeina	grs. 1– 2
	Chloroformum purificatum.	♏ 10–30

Class VII.—Tonics:		*Dose for an Adult.*
1. Simple Bitters.	—Quassiæ extractum	grs. 1– 3
	" tinctura	ʒ ¼– 1
	Gentianæ extractum	grs. 2– 3
	" " fld	♏ 10–30
	" tinctura comp	ʒ 1– 4
	Calumbæ, extract fld	♏ 15–30
	" tinctura	ʒ 1– 2
2. Aromatic Bitters.	—Serpentariæ, extract fld	ʒ ½– 1
	" tinctura	ʒ 1– 2
	Eupatoriæ, extract fld	ʒ ½– 1
	Eucalypti, extract fld	ʒ ½– 1
	Pruni Virginianæ, ext. fld	ʒ 1– 2
3. Mineral Acids.	—Acidum nitricum dil	♏ 5–20
	" sulphuricum dil	♏ 5–20
	" " aromatic	♏ 5–15
	" phosphoricum dil	♏ 15–30
	" nitro-hydrochloricum	♏ 2– 5
4. Astringent Metallic Salts.	—Ferri sulphas exsic	gr. ½– 3
	" chloridi tinct	♏ 10–30
	" nitras liquor	♏ 5–15
	" et quininæ citras	grs. 5–10
	" et strychninæ citras	grs. 2– 3
	Cupri sulphas	gr. ⅛–½
	Zinci sulphas	grs. 1– 3
Class VIII.—Cardiac Stimulants:		
	Ammonii carbonas	grs. 5–10
	Ammoniæ spiritus aromat	♏ 20–60
	Spiritus frumenti	℥ ½– 2
	Digitalis, extract fld	♏ 2– 5
	" tinctura	♏ 5–20
	Nucis vomicæ tinct	♏ 5–20
	Atropinæ sulphas	gr. $^1/_{120}$–$^1/_{60}$
Class IX.—Cardiac Sedatives:		
	Antimonii et pot. tart	gr. ⅛–¼
	" " " vinum	ʒ ½– 2
	Aconiti tinctura	♏ 2– 5
	Veratri viridis, ext. fld	♏ 2– 3
	" " tinctura	♏ 3– 5
	Gelsemii, ext. fld	♏ 3– 5
	" tinctura	♏ 5–20
Class X.—Excito-Motors:		
1. General Stimulants to Spinal Centers.	—Nucis vomicæ extract	gr. ¼–½
	" " tinctura	♏ 5–20
	Strychninæ sulphas	gr. $^1/_{20}$
	Ignatiæ extractum	gr. ¼–½
2. Oxytocics.	—Ergotæ, extract fld	ʒ ½– 1
	" vinum	ʒ 1– 2
	Ustilago, ext. fld	ʒ ¼– 1
	Gossypii, ext. fld	ʒ 1– 2
	Cimicifugæ, ext. fld	ʒ ½– 1
	" tinctura	ʒ 1– 2
	Sodii boras	grs. 10–30
3. Aphrodisiacs.	—Damiana	grs. 15–30
	Damianæ ext. fld	ʒ ½– 1
	Cantharidis tinctura	♏ 3– 5
	Cannabis Indicæ ext	grs. ½– 2
	Phosphorus	gr. $^1/_{16}$–[illegible]

Class XI.—Depresso-Motors:		*Dose for an Adult.*
1. General Sedatives to Spinal Centers.—	Physostigmatis ext	gr. 1/16–⅛
	" tinctura	♏ 5–10
	Potassii bromidum	grs. 30–60
	Ammonii bromidum	grs. 15–30
	Sodii bromidum	grs. 15–30
	Lithii bromidum	grs. 15–30
	Veratri viridis tinct	♏ 10–30
	Chloral hydrate	grs. 5–20
2. Antaphrodisiacs.—	Viburni ext. fld	ʒ ½– 1
	Viburnin	grs. 1– 3
	Camphora	grs. 10–20
	Conii extractum	grs. 2– 4
	" " fld	♏ 5–20
	" tinctura	ʒ ½– 1
	Lupulinæ, ext. fld	♏ 5–20
	" oleoresin	grs. 2– 5
	Lactucaria extractum	grs. 1– 4

DIVISION IV.—TOPICALS.

Class I.—Digestants:		
	Acidum arseniosum	gr. 1/24–1/20
	Ipecacuanhæ pulvis	gr. ¼-⅛
	Capsicum	grs. 2– 5
	Piperina	grs. 3– 5
	Pepsinum, saccharatum	grs. 5–20
	Ingluvin	grs. 5–15
	Pancreatinum, saccharatum	grs. 5–10
	Acidum hydrochloricum dil	♏ 5–10
	Acidum lacticum	♏ 20–30
Class II.—Astringents:		
1. Vegetable.—	Acidum tannicum	grs. 10–20
	" gallicum	grs. 5–15
	Catechu tinct	ʒ 1– 2
	Hæmatoxyli extractum	grs. 10–30
	Kino tinctura	ʒ 1– 2
	Krameriæ, ext. fld	♏ 10–20
	" syrupus	ʒ ½– 4
	Hammamelidis, ext. fld	ʒ ½– 1
2. Mineral.—	Plumbi acetas	grs. 2– 5
	Alumen	grs. 10–40
	Bismuth sub. carbonas	grs. 20–40
	" " nitras	grs. 20–40
	Cerii oxalas	grs. 1– 3
	Zinci sulphas	grs. 1– 3
	" oxidum	grs. 3– 5
	" acetas	grs. 1– 2
	Cupri sulphas	grs. 1– 2
	Argenti nitras	gr. ¼–½
Class III.—Anthelmintics:		
1. Lumbrici.—	Santoninum	grs. 2– 4
	Spigeliæ, extract fld	ʒ 1– 2
	" et sennæ, ext. fld	ʒ 2– 4
	Chenopodii oleum	♏ 5–10
2. Tænia.—	Aspidii oleoresina	ʒ ½– 1
	Brayeræ, ext. fld	ʒ 2– 4
	Kamalæ tinct	ʒ 1– 4
	Pepo, extract fld	℥ ½– 1
	Pelletierinæ tannas	grs. 3– 6

RECENT CHANGES IN DOSAGE BY THE UNITED STATES PHARMACOPŒIA, 1880.

Much objection has been raised against the last revision of the United States Pharmacopœia, under the apprehension that great and radical changes were made concerning the standard strength of our most important officinal preparations; but a glance at the following tables, presented by Oscar Oldberg, Phar. D., will show that such objections have, in fact, but little if any foundation.

The first table represents those important and potent agents whose strength has been augmented in the new and sixth decennial revision of the United States Pharmacopœia.

ARTICLES.	Dose of 1870.	Dose of 1880.
Solution arsenious acid	5 minims.	4⅛ minims.
Liquor potassii arsenitis	5 "	4⅛ "
Tinct. opii	13 "	11 "
Tinct. cantharides	10 "	7 "
Tinct. capsicum	20 "	14 "
Tinct. lobelia	40 "	30 "
Tinct. aloes	1 to 6 f ℨ	⅛ to 2 f ℨ

The following is a list of those preparations of which the strength has been considerably diminished:

ARTICLES.	Dose of 1870.	Dose of 1880.
Vinegar of lobelia	40 minims.	55 minims.
" " opii	7 "	11 "
" " sanguinaria	15 "	20 "
" " squill	15 "	20 "
Tinct. aconite	2⅛ "	8 "
" cannabis Indica	10 "	17 "
" nux vomica	20 "	35 "
" stramonium	10 "	18 "
" veratrum viride	5 "	5⅛ "
Wine of opium	8 "	11 "

From the above tables it will be seen that the strength of the tincture of opium has been increased fifteen and a half per cent, while that of the vinegar of opium has been reduced thirty-three per cent; but an advantage is gained in making all the stronger liquid preparations of this drug—i. e., the simple and the deodorized tincture, the vinegar and the wine—of uniform strength, being made from assayed opium, which gives the strength of six grains of morphine to the fluidounce, or one eighth of a grain to every ten minims, and representing ten per cent of the strength of the crude drug.

TABLE OF NUMBER OF DROPS IN A FLUIDRACHM.

ARTICLES.	From bottles.*	From minim measure.
Acetum colchici	75	80
" destillatum	78	75
" opii	90	69
" scillæ	78	70
Acidum aceticum	73	102
" hydrocyanicum	53	52
" " dilutum	45	48

* According to measurements by Durand, Procter, Parrish, and others. Some of these measurements are from ordinary bottles, others from Oj tincture bottles. As a rule, the size of the drop depends upon the amount of water the liquid contains: the greater the amount of water, the larger the drop and the fewer of them to the drachm.

ARTICLES.	From bottles.	From minim measure.
Acidum muriaticum	54	58
" nitricum	84	80
" " dilutum	62	44
" sulphuricum	90	75
" " aromaticum	116	148
" " dilutum	54	49
Alcohol	118	148
" dilutum	98	124
Aqua	64	46
" ammoniæ	49	62
Creasotum	91	95
Chloroform	180	276
Ether	150	190
Glycerine	55	85
Liquor iodinii compositus	75	75
" hydrargyri et arsenici iodidi	52	52
" potassæ arsenitis	60	63
Oleum amygdalæ dulcis	120	124
" anisi	85	86
" carui	106	108
" caryophylli	103	103
" chenopodii	97	100
" cinnamomi	100	102
" cubebæ	86	96
" fœniculi	103	103
" gaultheriæ	102	101
" menthæ piperitæ	103	109
" olivæ	76	99
" rosmarini	104	105
" sabinæ	102	108
" sassafras	102	100
" tiglii	80	92
Spiritus ætheris nitrosi	90	148
" " compositus	90	140
Syrupus acaciæ	58	56
" scillæ	85	88
Tinctura aconiti	118	130
" asafœtidæ	120	186
" digitalis	120	130
" ferri chloridi	106	151
" guaiaci	120	140
" iodinii	144	113
" opii	147	106
" " camphorata	110	95
" tolu	188	120
Vinum antimonii	87	62
" colchici	75	80
" opii	92	78

GRADUATED TABLE FOR ADMINISTERING LAUDANUM.

For a child at birth, or one month old	¼ to ⅓ drop.
Under a year old	⅓ to 2 drops.
From one to two years	1 to 4 "
" two to five years	2 to 7 "
" five to ten years	5 to 12 "
" ten to fifteen years	10 to 18 "
At fifteen	15 to 18 "
For an adult	20 to 30 "

It is important, in the employment of tincture of opium, that it should be of the proper strength and perfectly clear. A good rule for its administration is to allow *one drop for each year of age* (from one to thirty years), and o repeat this dose at intervals of one to eight hours, according to the degree f pain or the emergencies of individual cases.

TABLE OF QUANTITIES NOT TO BE EXCEEDED IN PRESCRIPTIONS WITHOUT THE USE OF THE CAUTION-MARK, (!) TO INDICATE THAT THE PRESCRIBER IS AWARE OF THE UNUSUAL SIZE OR FREQUENCY OF THE DOSE.*

ARTICLES.	Single doses.	Aggregate in one day.
Acid, arsenious	1/6 grain.	½ grain.
Acid, hydrocyanic, diluted	4 minims.	20 minims.
Acid, nitromuriatic	4 "	30 "
Aconite leaf, extract of	1½ grain.	10 grains.
Aconite root, fluid extract of	3 minims.	8 minims.
Aconite root, tincture of	6 "	15 "
Aconite root, Fleming's tincture of	3 "	8 "
Aconitia and its salts	1/50 grain.	1/10 grain.
American hellebore, fluid extract of	4 minims.	10 minims.
American hellebore, tincture of	5 "	10 "
Antimony and potassium, tartrate of	2 grains.	
Arseniate of sodium	⅛ grain.	1 grain.
Arsenic, solution of chloride of	6 minims.	15 minims.
Arsenic, iodide of	1/6 grain.	½ grain.
Arsenic and mercury, solution of iodides of	10 minims.	30 minims.
Arsenite of potassium, solution of	15 "	40 "
Atropine and its salts	1/60 grain.	1/20 grain.
Belladonna, extract of	1 "	5 grains.
Calabar bean, extract of	¼ "	1 grain.
Codeine	2 grains.	5 grains.
Coniine	1/60 grain.	1/20 grain.
Conium, extract of	2 grains.	8 grains.
Croton-oil	2 minims.	
Cyanide of potassium	¼ grain.	1 grain.
Digitalin	1/50 "	1/20 "
Digitalis, extract of	⅛ "	1 "
Hyoscyamus, extract of	3 grains.	10 grains.
Ignatia, extract of	2 "	6 "
Indian hemp, extract of	1 grain.	3 "
Mercury, corrosive chloride of	¼ "	½ grain.
Mercury, iodide of, red	1/6 "	1 "
Mercury, iodide of, yellow	½ "	2 grains.
Morphine and its salts	½ "	2 "
Nux vomica, extract of	2 grains.	5 "
Opium	2 "	8 "
Opium, extract of	1 grain.	4 "
Opium, tincture of	20 minims.	80 minims.
Phosphorus	1/5 grain.	½ grain.
Stramonium leaves, extract of	2 grains.	5 grains.
Stramonium seed, extract of	1 grain.	3 "
Strychnia and its salts	1/12 "	¼ grain.

* Arranged by a joint committee of the Medical Society of the District of Columbia and the National College of Pharmacy.

TABLE OF PROPORTIONAL QUANTITIES.

Table showing the quantity of opium and of certain preparations of antimony, arsenic, iodine, and mercury, entering into their respective pharmaceutical compounds:

Acetum opii contains gr. j of opium in	♏ ix.
Confectio " " " " "	grs. xxxvj.
Extractum opii " " " "	gr. j.
Pilulæ " " " " "	pill j.
" saponis compositæ contains gr. j of opium in	grs. v.
Pulvis ipecacuanhæ compositus contains gr. j of opium in	grs. x.
Tinctura opii contains gr. j of opium in	♏ xj.
" " acetata contains gr. j of opium in	♏ x.
" " camphorata contains gr. j of opium in	f℥ ivss.
" " deodorata " " " "	♏ xss.

Trochisci glycyrrhizæ et opii contains gr. j of opium in.........	troches x.
Vinum oppii " " " "	♏ xss.
Liquor morphinæ sulphatis contains gr. j of morphine in	f℥ j.
Magendie's solution of morphinæ sulphatis contains gr. j in.....	♏ xxx.
Vinum antimonii contains gr. j of ant. et pot. tart. in..........	f℥ ss.
Syrupus scillæ compositus contains gr. j of ant. et pot. tart. in..	f℥ j.
Liquor arsenici et hydrargyri iodidi (Donovan's solution), gr. j each of iodide of arsenic and red iodide of mercury in......	fʒ ii.
Liquor potassæ arsenitis, gr. j of arsenious acid in.............	fʒ ij.
Tinctura iodi, gr. j of iodine in............................	♏ xvj.
" " composita, gr. j of iodine and grs. ij iodide of potassium in..	♏ xxxij.
Liquor iodi compositus (Lugol's solution), gr. j of iodine and grs. ij iodide of potassium in............................	♏ xx.
Syrupus ferri iodidi, gr. j of iodide of iron in..................	♏ x.
Hydrargyrum cum creta, gr. j of mercury in...................	gr. ij⅜.
Pilulæ hydrargyri, gr. j of mercury in......................	grs. iij.
Vinum ipecacuanhæ, gr. j of ipecac in.......................	♏ xv.
" ergotæ, gr. j of ergot in............................	♏ vii.
Tinctura belladonnæ, gr. j of belladonna in..................	♏ vii.

Doses of Medicines for Hypodermic Injections for an Adult.

Atropinæ sulphas..	gr. 1/60–1/30.
Liquor opii comp. (Squibb's)................................	gtt. v–lx.
" morphinæ sulphatis (Magendie's solution)..............	gtt. iij–xx.
Morphinæ hydrochloras....................................	gr. ⅛–¾.
" sulphas..	gr. ⅛–¾.
Quininæ sulphas (neutral solution).........................	gr. ij–iv.

Formulæ and Doses of Medicines for Hypodermic Injections.

1. ℞ Atropinæ sulphatis, gr. j; aq. dest., ʒj; glycerini, ʒvij. Five minims = gr. 1/96. Dose, 1/96 to 1/24. *Use:* Opium poisoning, sciatica, tetanus, congestive chill, etc.

2. ℞ Atropinæ sulphatis, gr. j; morphinæ sulphatis, grs. xvj; aq. dest., ʒj; glycerini, ʒvij. Dissolve. Five minims = gr. 1/6 of morphine and 1/96 of atropine. *Use:* Insomnia, neuralgia, rheumatism, angina pectoris, etc.

3. ℞ Caffeinæ citratis, gr. j; glycerini, gtt. xxiv. For one injection. *Use:* Opium poisoning, neuralgia, hysterical headache.

4. ℞ Strychninæ sulphatis, gr. j; aq. dest., ʒj; glycerini, ʒvij. Ten minims = gr. 1/48. *Use:* Paralysis, neuralgia, etc.

In the above formulæ, drop the required dose in a teaspoon, and add sufficient water at the time of using.

The advantage of using glycerine as the vehicle and solvent of the alkaloids is that, unlike the aqueous solutions, it will keep for any length of time without freezing, precipitation, or decomposition. Its solvent power is increased by heating.

5. ℞ Extracti ergotæ fluid, ♏xv. For one dose. *Use:* Post-partum and other hæmorrhages.

6. ℞ Extracti physostigmatis, gr. ij; aq. dest., ʒj. Filter. Ten minims = gr. ⅙. *Use:* In tetanus and strychnine poisoning. Prepare when wanted.

7. ℞ Ergotini, gr. ij; alcoholis, ʒss.; glycerinæ, ʒss. Five minims = gr. 1/6. *Use:* Post-partum hæmorrhage.

In malarial fevers, and in malarial neuralgia, etc., the following formula may be used: Quin. sulph., gr. lx; acid sulph. dil., gtt. lx; aquæ dest., f℥j. Mix. Filter with care. Thirty-five minims contain grs. iv of quinine.

As a general rule, half the ordinary stomachic dose ought to be used for men; one third for women. First injection ought to be smaller than subsequent ones, for the sake of safety. Chronic cases require larger doses than

acute. In delirium tremens, mania, tetanus, and paralysis, the first quantity injected may be greater and more powerful than in cases of neuralgia. But caution as to the quantity of morphine should be exercised in the hypodermic use of this agent with weak anæmic females and patients in the decline of life. In such cases, where tolerance is unknown, gr. 1/8 may prove dangerously narcotic.

Doses of Medicines for Inhalation.

For steam atomizer, fine spray. The quantities given are to f℥j of water.

Acidum tannicum—in bronchial affections, with excessive secretion. In pulmonary hæmorrhages, in œdema of glottis (Trousseau), and in croup, the dose is much larger, and may be united with opium............... gr. j–xx.

Alumen—in the same affections as tannin. As an astringent, more sedative and better suited to conditions of irritation than tannin....... gr. x–xx.

Ammonii chloridi—to promote expectoration. In laryngeal and bronchial catarrh, acute and chronic; in capillary bronchitis. As much as ʒij to the f℥j have been employed.................................... gr. x–xx.

Argenti nitras—in follicular pharyngitis, in ulcerations of pharynx and larynx, a face-shield being always employed. (Only in ulcerations, grs. x to f℥j.).. gr. j–x.

Aqua calcis—in membranous croup, diphtheria....... officinal strength.

Cannabis tinctura—in phthisis and spasmodic coughs........... ♏ v–x.

Conii extractum fluidum—in asthma; feeling of irritation in larynx; irritative cough... ♏ iij–viij.

Or the solid extract, gr. ss.–iij to f℥j aq.

Ferri perchloridum—in earlier stages of phthisis; hysterical aphonia. In chronic pharyngitis, or laryngitis, may be used stronger. (In hæmoptysis, gr. ij–x to the f℥j.).. gr. 1/8–ij.

Hyoscyami extractum fluidum—whooping-cough; spasmodic coughs. The solid extract may be used gr. 1/2 to the f℥j, gradually increased. ♏ iij–x.

Liquor ferri subsulphatis (Monsel's solution)—in hæmoptysis... ♏ x–xl.

Liquor iodi compositus (Lugol's solution)—in phthisis; in chronic bronchitis... ♏ ij–xv.

Liquor potassii arsenitis—nervous asthma (Trousseau).......... ♏ j–xx.

Liquor sodæ chloratæ—in phthisis; in bronchitis, with copious and offensive expectoration .... fʒ ss.–j.

Morphinæ acetas—in irritative coughs and for constitutional effect, gr. 1/32–1/8.

Or opium may be used, as follows:

Opii extractum .... gr. 1/4–1/2.

Opii tinctura.. gtt. iij–x.

Plumbi acetas—in obstinate trouble, some colds not yielding to other remedies. Pulmonary hæmorrhages............................ grs. ij–x.

Potassii arsenitis liq.—in nervous asthma..................... gtt. j–x.

Potassii chloras—in chronic and subacute catarrhal affections, especially with dryness of mucous membranes.......................... grs. x–xx.

Potassii bromidum—in laryngeal croup...................... grs. v–xx.

Potassii iodidum—in emphysema and chronic bronchitis.... grs. ij–xxx.

Potassii permanganas—antiseptic.......................... grs. ij–v.

Sodii chloridum—in phthisis used to promote expectoration.. grs. v–xx.

℞ Acid carbolici, grs. ij–x; acid lactici, ʒ 1/8–ʒ 1/2; aquæ calcis, ℥i. In diphtheria as an antiseptic and resolvent.

Zinci sulphas, grs. ij–v; morphinæ sulphas, gr. 1/8. Astringent in bronchial catarrh with excessive secretion. In aphonia connected with chronic laryngeal catarrh.

Notes.—The first few inhalations from a steam atomizer should be short, to prepare the patient for their use. Afterward they may be continued for ten minutes.

The patient should not take more than six or eight inspirations per minute, and should breathe deeply if the remoter air-passages are to be reached.

Inhalations should never be performed after a hearty meal, and the patient should remain in-doors for thirty minutes after the operation. In addition to the substances mentioned, any medicinal agent soluble in water, in a watery solution of an aromatic, or in a very dilute alcohol, can be used by an ordinary steam atomizer. Substances soluble in glycerine or capable of being suspended in their emulsions may be employed, but not, as a rule, with satisfaction. Generally speaking, the dose does not differ very materially from that employed internally. This does not hold good of narcotics, which act efficiently in smaller doses, nor of astringents, in the use of which the dose should be carefully graduated to the delicacy of the deeper structures. The solutions should be made with distilled water, and some, as tannin, strained. Always begin with small doses, in order to educate the respiratory mucous membrane to tolerance.

Vapor Inhalations.

For the ordinary inhaler, one teaspoonful of the following formulæ, added to one pint of water at the designated temperatures, will be the dose for inhalation:

Acidi hydrocyan., dil., ʒ ij; aquæ, ℥ ij (80° F.), sedative in cough; laryngeal cough of phthisis.

Aqua ammoniæ, alcoholis, āā ℥ ss. (100° to 120° F.), stimulant in chronic laryngitis; functional aphonia.

Amyl nitrite, ʒ j; alcohol, ℥ j (100° F.), antispasmodic in asthma and spasm of the glottis.

Benzoini tinct. comp., ℥ ij (130° to 150° F.), sedative in acute pharyngitis and laryngitis.

Cubebæ olei, ʒ ij; magnes. carb. levis, ʒ j; aquæ, ℥ iij (150° F.), stimulant or blennorrhetic.

Conii succi., ʒ ij; sodii carb., grs. x (140° F.), for one inhalation, sedative.

Creasotii, ℥ ij; magnes. carb. levis, ʒ jss.; aquæ, ℥ iij (120° to 150° F.), stimulant in chronic congestion of the larynx, and ozæna.

Terebinthinæ Canad., ʒ ij; magnes. carb. levis, ʒ j; aquæ, ℥ iij (140° F.), mild stimulant and resolvent; may be rendered more stimulant by the addition of gr. v of camphor.

Olei terebinth., spts. chloroform, āā ℥ j (100° F.), for chronic bronchitis.

Tr. iodi, ℥ j; potassii iodidi, ʒ j (120° F.), inhaled frequently in acute laryngitis and in nasal passages for its alterative impression in scrofulous catarrh.

Doses of Medicines for Rectal and Vaginal Suppositories.

They should be made of cacao-butter (about ʒ j with ʒ ¼ of olive-oil, to each), which is firm and consistent when cold, while it melts at a low temperature and with great rapidity. Besides morphine and the opiates, there is a great variety of remedies which may be usefully applied in this way, both for local and constitutional effect. Dupuytren has pointed out that sometimes opium affects patients more powerfully when administered by the rectum than in the ordinary way. In general, one third of a grain of morphine is the preferable dose in a suppository, as in exceptional cases a half-grain seems to act too powerfully. Cathartics may be introduced into the rectum, and often afford relief to patients without their being subjected to the disagreeable ordeal of swallowing some nauseous medicine. The gamboge suppository, when introduced into an *empty* bowel, sometimes gives rise to severe griping, and the use of the podophyllin suppository has been followed by prolonged diarrhœa.

Davis's improved suppository molds are the most convenient and economical for ordinary use; but by using the dry powdered extracts of such arcotics as opium, belladonna, and hyoscyamus, triturating them with oleum eobromæ and filling the larger sized gelatine capsules, which hold twenty

grains, the physician can extemporize very efficient suppositories, which may be carried in his pocket-case without melting in hot weather.

Rectal Suppositories.

Aloin (with dry soap, gr. v.)	gr. j.
Belladonnæ extractum	gr. 1/3–ij.
Cupri acetas (in bleeding piles)	gr. ij.
Elaterium	gr. 1/3.
Ergotine	gr. 1–11.
Ferri subsulphas	gr. ij.
Gamboge	gr. v.
Hyoscyami extractum	gr. v.
Hydrargyri unguentum (for ascarides, etc.)	gr. vj.
Morphinæ sulphas, or hydrochloras	gr. 1/4–ij.
Opium	gr. ij.
Podophyllin	gr. j.
Santonin	gr. v.
Tannic acid	gr. v.

Vaginal Suppositories.

Alum (astringent)	gr. xv.
Atropine (sedative)	gr. 1/20.
Bismuthi oxidum (cicatrizing and emollient)	gr. xv.
Ferri subsulphas (hæmostatic)	gr. v.
Hydrargyri ung. (alterant and resolvent)	gr. x to xx.
Iodoform (antiseptic)	gr. ii–v.
Morphinæ sulphas (sedative)	gr. 1/3 to ij.
Opium "	gr. ij.
Plumbi iodidum (alterant and resolvent)	gr. v to x.
" acetas (astringent)	gr. vij.
" " et opium (astringent)	gr. v et gr. ij opii.
Tannic acid (astringent)	gr. x to xv.
Zinci oxidum (cicatrizing and emollient)	gr. xv.

Medicated uterine pessaries may be made of the diameter of an ordinary stick of nitrate of silver, and introduced into the canal of the uterus. The dose of the medicine should be less than in the vaginal pessary.

Mitchell's soluble gelatine urethral bougies and intra-uterine pencils, and fistula crayons, afford convenient and efficient means for treating chronic diseases of the genito-urinary passages.

Eye-Washes.

The following are the amounts to be employed to one ounce of distilled water: Alumen, grs. j–viij; argenti nitras, grs. j–x; atropine, grs. ij–iv; duboisine, grs. j–ij; daturine, gr. ss.–j; eserine, gr. j; plumbi acetas, grs. ij–iv; zinci acetas, grs. ij–iv; zinci sulphas, grs. ij–iv.

Note.—The salts of silver and lead should not be used where ulceration of the cornea exists, as opacity from the deposit of these metals is apt to occur.

To meet the indications of an ordinary case of subacute conjunctivitis, the following eye-wash will be found very efficient:

℞ Zinci sulphatis, grs. iv; morphinæ sulphatis, gr. j; aquæ destil., ʒ vij; glycerini, ʒ j. M. Ft. collyria, and apply by means of a medicine-dropper, eight or ten drops, *pro re nata.*

Gonorrhœal Ophthalmia.

℞ Zinci sulphatis, grs. ij; atropinæ sulphatis, gr. ss.; acid. carbolic, gr. j; aquæ rosæ, ℥ j. M. Apply three or four drops three or four times daily, and also externally with linen cloths.

Nasal Douches.

Solutions of medicines are frequently employed topically in the treatment of diseases of the nasal passages, such as lupus of the nose, syphilitic ozæna, acute coryza, but more frequently in chronic nasal catarrh.

Although many cases of acute coryza pass into the subacute or chronic form, yet, in the vast majority of cases, the disease occurs in *persons suffering under some dyscrasia*, and in the treatment of the disease the *first indication* is to build up the system according to whatever cachexia may exist. Patients may be either anæmic, scrofulous, tuberculous, or syphilitic. When *anæmic*, give quinine and iron; if *scrofulous*, give the syrup of iodide of iron and cod-liver oil; if *tuberculous*, give arsenic, cod-liver oil, syrup hypophosphite of iron, soda, magnesia, and lime; and if *syphilitic*, mercury, or the iodide of potassium and comp. syr. sarsaparilla, or stillingia, etc. But local treatment is of the utmost importance also, and the remedies are, first, *resolvents* to soften and loosen the secretions, to hasten their removal, and to prevent their retention, as cleanliness in this affection is an indication paramount to everything else.

The *second indication* is the employment of *astringents* and *alteratives* to restore the hyperplastic or abnormal secretion of the mucous membrane to its natural condition. The *third indication* calls for the use of *disinfectants* or *deodorizers*, to remove the stench, if present.

In regard to the use of topical applications, it is well to remark that the water used should have an alkaline reaction, as pure water is irritating to the Schneiderian membrane, exciting lachrymation and sternutation (tears and sneezing), swelling the mucous membrane, and causing a copious discharge of watery mucus from the nasal passages. Alkaline solutions agree best with the mucous membrane, serve best to dissolve the crusts and hardened mucus, and on this account the following remedies are brought up to the requisite specific gravity by alkaline salts, which do not decompose the other medicinal agents with which some of them are combined. The water in which the desired medicine is dissolved should always be *tepid*, never cold, unless to restrain hæmorrhage.

The following formulæ are adapted to the use of ordinary douche-vessels containing six ounces of fluid.

Resolvents.

℞ Sodii chloridi, ℥j; sacchari albi, ℥j. M. S. Teaspoonful to aqua, tepid, ℥vj. And use once or twice daily.

℞ Sodii carb. (C. P.), ℥ij. S. Teaspoonful to aqua, tepid, ℥vj. And use once or twice daily.

℞ Potassii chloratis, ℥ij. S. Teaspoonful to aqua, tepid, ℥vj. And use once or twice daily.

℞ Ammonii chloridi, ℥ij. S. Teaspoonful to aqua, tepid, ℥vj. And use once or twice daily.

N. B.—About the same quantity of glycerine may be advantageously added to either of the foregoing resolvent washes.

The second indication is to be governed by the ætiological conditions. In syphilitic rhinitis, use the following:

℞ Hydrarg. chlorid. corrosivi, grs. xvj; alcoholis, ℥j; glycerini, ℥j. M. S. Shake, and use a teaspoonful to aqua, tepid, ℥vj. Once or twice daily.

In scrofulous constitutions:

℞ Tr. iodi comp., ʒjss.; glycerini, ℥ij. M. S. Teaspoonful to aqua, tepid, ℥vj.

Also for the same:

℞ Iodi, ʒss.; potassii iodidi, ʒj; glycerini, ℥ij. M. S. Teaspoonful to aqua, tepid, ℥vj. Once or twice daily.

N. B.—The last formula is very useful in scrofulous catarrh, when the charge is profuse and offensive.

In chronic nasal catarrh without any constitutional cause, and when the

discharge is abundant, any of the entire array of astringents may be employed, but should be used only as long as there is swelling of the mucous membrane and an *increase of its secretions is present.*

The dry and atrophic forms do not bear astringents, and in them we should confine the treatment to cleanliness and disinfectants.

Best Astringents.

℞ Pulv. alum, ʒ ij. S. ʒ j to aqua, tepid, ℥ vj.

N. B.—A small quantity of permanganate of potassium may be added to the above.

℞ Zinci sulph., ʒ ij; magnesii sulph., ℥ ij; or sodii sulph., ℥ ij. M. S. ʒ j to aqua, tepid, ℥ vj.

℞ Plumbi sub. acetatis, ʒ iv; sodii acetatis, ℥ ij. M. S. ʒ j to aqua, tepid, ℥ vj.

℞ Cupri sulph., ʒ ss.; acidi tannici, ℥ ss.; glycerini ℥ ij. M. S. ʒ j to aqua, tepid, ℥ vj.

Best Alteratives.

℞ Argent. nitratis, ℈ ij; sodii nitratis, ℥ j; or potassii nitratis, ℥ ss.; aqua, q. s. to make ℥ ij. M. S. ʒ j to aqua, tepid, ℥ vj.

℞ Hydrarg. chlorid. corrosivi, grs. xvj; sodii chloridi, ℥ j; aqua, q. s. to make ℥ ij. M. S. ʒ j to aqua, tepid, ℥ vj.

N. B.—Shake well and use with great caution, as it has a tendency to produce excoriations upon healthy surfaces.

Solutions of chloride of lime with suspended oxide of mercury, to which salt is added.

"Black Wash."

℞ Hydrarg. chloridi. mitis, ʒ ij; aquæ calcis, ℥ xij; sodii chloridi, ℥ j; aqua, tepid, ℥ xx. M. S. Shake well and use without dilution.

"Yellow Wash."

℞ Hydrarg. chloridi corrosivi, ℈ j; aquæ calcis, ℥ xij; sodii chloridi, ℥ j; aqua, tepid, ℥ xx. M. S. Shake well before using.

Sedative Solutions.

℞ Tr. opii, ʒ ss.; aqua, tepid, ℥ vj. M. S. Use without dilution.

Styptic Solutions.

℞ Liquor ferri sub. sulph., ʒ iv; aqua, tepid, ℥ vss. M. S. Use full strength.

℞ Fld. ex. ergot, ʒ iv; aqua, tepid, ℥ vss. M. S. Use full strength.

Stimulating Solutions.

℞ Alcohol, ʒ iv; or eau de cologne, ʒ iv; aqua, tepid, ℥ vss.; sodii chloridi, ʒ ij. M. S. Use full strength.

N. B.—Use *watery solutions* to swell the mucous membrane and produce *endosmoses.* When it is desired to produce *exosmoses,* and shrivel the Schneiderian membrane, use highly concentrated solutions.

Disinfectant Solutions.

℞ Potassii permanganatis, grs. xvj; aqua, ℥ ij. M. S. ʒ j to aqua, tepid, ℥ vj.

℞ Liq. sodæ chlorinatæ, glycerini, āā ℥ j. M. S. Use ʒ j to aqua, tepid, ℥ vj.

℞ Acid carbolic, ʒ j; glycerini, ℥ ij. M. S. ʒ j to aqua, tepid, ℥ vj.

N. B.—These remedies may be combined with the other preparations if indicated.

Snuffs for Nasal Catarrh.

℞ Camphoræ pulv., sacchari, āā ℥ j. M. S. Use *ad libitum* after resolvent washes.

℞ Hydrarg. chloridi. mitis, ℈ij; hydrarg. ox. rubri, grs. xv; magnesiæ, ʒij. M. S. Use a pinch as snuff five or six times daily in chronic ulcerations and in syphilitic rhinitis. (Trousseau.)

℞ Cubebæ pulv., ℥j. S. Use a pinch as snuff several times daily in acute coryza, after the first stages of congestion and dryness have subsided. Very useful as soon as the discharge becomes profuse.

℞ Cubebæ pulv., camphoræ pulv., āā ℥ss. M. S. Use same as the above.

In conclusion, we will say that, by the judicious use of such of the foregoing formulæ as the nature of the case indicates, the physician will find that *chronic nasal catarrh* no longer belongs to the opprobrium of medical art, but is a curable disease, and can be treated not only with profit to the physician, but with the greatest satisfaction and advantage to his patients.

Art of Combining Drugs.

Having in the preceding pages presented the individual articles of the materia medica, we are now led to the consideration of the combination of drugs. The first thing to be decided in writing a prescription is the object for which we order a certain combination of drugs. We must interrogate ourselves as to what symptoms we wish to alter or modify, and what is to be our principal ingredient, and in what quantity. This being duly settled in our minds, we reflect whether it is better to give this particular article by itself, or to associate it with other substances which may possibly assist or mitigate its action, or which may, at all events, conceal its more or less nauseous taste. It is very common that in our prescriptions we should aim at simplicity as much as possible; and this holds good within certain limits. The old-fashioned custom was to string together a long list of ill-understood substances, in the hope that some one or other of them would "hit the right nail on the head." But this polypharmacy of our predecessors in the profession, usually called "shot-gun" prescriptions, have measurably disappeared, and the "jug of sundries" has been set aside, we trust, to be used no more forever: not, however, giving rise to any nonsensical "law of the single remedy," as homœopathy advocates, but to a clear insight into the "synergic" action of medicines, by virtue of which a judicious association of several drugs, acting in a given direction, will produce a more forcible and satisfactory result than can be obtained by the administration of any one of them separately, however well selected.

If, however, we are tolerably certain of the action of a drug and desire its special action, or, more particularly, when making scientific observations upon its mode of action, then it is often of great importance that we should not obscure its effects by the addition of any other active substance, but order either simply in distilled water, or merely combined with other ingredients for flavoring purposes. But, with these few exceptions, this principle should not be carried too far. If, in a given case, better results can be obtained by the union of two or more drugs, they should be so combined; indeed, there is no fact more thoroughly proved in therapeutics than the value, under certain conditions, of due combination, and the way in which one drug may assist the action of another.

This principle is well illustrated in the action of diuretics; for it is well known that a prescription containing three or four members of this group will often prove efficient when one produces little or no effect, and that mercury is of undoubted service in assisting the influence of squill and digitalis over the urinary excretion. What is said of diuretics is equally true of purgatives, expectorants, tonics, anthelmintics, and, in fact, most all other classes of remedies to a greater or less degree. Hence it may be laid down as a rule that a rational combination of drugs, acting in the same direction, is far more effective in its operation than any single medicine. But it is a natter of much importance that we make ourselves well acquainted with hose several combinations which either increase or modify the action of cer-

tain remedies. A few examples may be cited to further illustrate the influence which this circumstance exercises. The combination of a small amount of opium or morphine with the salts of quinine is known to prevent the occurrence of those disagreeable nervous symptoms commonly produced by the last-named drug, while at the same time the opium increases its anti-periodic powers, so that smaller doses produce the same therapeutic effect. But perhaps the best mode of obviating the discomfort of cinchonism consists in the addition of hydrobromic acid or fluid extract of ergot to the quinine; and if, in addition to this, we employ the aromatic elixir, or fluid extract of liquorice, as the vehicle, we may thus very efficiently overcome two very strong objections on the part of patients in regard to an invaluable medicine.

Again, by due combination of atropine with morphine, larger doses may be given, and more curative effects obtained in severe neuralgic affections.

In fact, narcotics often gain in potency by combination: thus, potassii bromide and chloralhydrate together will more certainly produce sleep than either of these drugs given separately; and should pain also coexist, then efficiency is still further enhanced by the addition of opium. Again, the advantage to be derived by the addition of a little iron to the digitalis which we give as a cardiac tonic, and to ergot or aloes, which is to stimulate the uterine functions, are facts familiar in the experience of every practitioner, knowing, as he does, the important *rôle* which an improved blood-supply necessarily plays under these circumstances. Then we all know how jalap aids the peristaltic intestinal contractions to remove the watery fluid which the bitartrate of potash drains into the bowels. On the contrary, the purgative action of some drugs, such as aloes, is rendered milder by the addition of ipecac, less griping by extract of hyoscyamus, while it is modified by soap, the aromatic oils, and by the alkalies.

Prescription-Writing.

In the practical use of remedies very much depends upon the method of their combination, and, so far as concerns the reputation of the physician and his success as a practitioner, no little importance is to be attached to the mere prescription-writing. Though a crooked, bad handwriting may be the traditional work of learning, yet absolute plainness should be the *sine qua non*. A physician's prescriptions are widely seen, often criticised; and he who departs without reason from the established forms lays himself open to ridicule—than which nothing is more damaging.

In commencing a prescription, a certain order should be observed—the most important symptoms and indications dictating the kind and position of the articles to be used. Every word should be plainly and fully written, so that the dispenser may not be confused by hieroglyphics or senseless abbreviations. After the ingredients are arranged in proper order—that is, placing the most active medicine first on the list as the basis, with its adjuvant, corrigent, and vehicle, if any, in succession—the number of doses to be made up must be decided; then each article must be considered separately and the single dose determined. This done, the single dose must be multiplied by the whole number of doses, and thus expressed in the appropriate symbols opposite the drug in question.

The ingredients should be blended so far as possible to secure an agreeable appearance, taste, and smell, and the avoidance of incompatibles.

A combination of drugs in a prescription is generally intended to assist or modify their action. Posology is a very important consideration in a prescription, and the physiological effect of the drug is largely determined by the dose.

Accuracy in dose is of prime importance, and no medicine should be given until the physician is satisfied as to the dose, both maximum and minimum. No guessing at doses, even of comparatively harmless medicines, should be allowed, else the habit of thinking lightly of this subject, and dependence on a mere guess, may result in a serious case of poisoning. A knowledge of both

maximum and minimum doses is essential, since it often determines a special action, and in the dose do we alone find a poison differing from a medicine.

For instance, ipecac, in gr. $^1/_6$ to $\frac{1}{4}$ is an anti-emetic and stomachic, in gr. $\frac{1}{4}$ to $1\frac{1}{4}$ it is an expectorant and diaphoretic, and in still larger doses it is an emetic. This affords a striking illustration of the desirability of correct posological information, since the dose that is to be employed should be in accordance with the desired specific action.

Doses are divided into three kinds: Maximum is one capable of producing a full, strong physiological action; a medium dose produces an action just short of a full one; and a minimum dose will produce the slightest evidence, often requiring a considerable period of time to manifest even this.

A difficulty in laying down absolute minimum and maximum doses often exists, and is influenced, not by the drug alone, but by a peculiar idiosyncrasy or condition of the patient. Thus, a dose which in one will produce no appreciable effect, will, in another, produce marked and alarming activity.

The doses in these idiosyncratic cases must, then, be determined by personal observation or preliminary inquiry, and the dose regulated in accordance.

Repetition in the use of a drug has much to do with its future action, and, by a frequent or prolonged use, marked tolerance is established, and a dose which in the first place would produce full effect will, later on, have but little or no influence.

Soluble salts may be given in solution; insoluble salts and powders, if given in the form of a mixture, should be suspended by the aid of *mucilage* or *syrup*. Powders or salts may be given in powder or in pills—the latter not to exceed four or five grains, and made usually with *conf. of rose*, *mucilage*, *starch*, *extracts*, etc.

Correctives may be added to disagreeable medicines to prevent the nauseating properties, such as comp. tinct. of cardamom, tinct. of ginger, peppermint-water, fluid extract of liquorice, oil of wintergreen, comp. cinnamon powder, ginger, etc. Gelatine capsules make good carriers for bitter and disagreeable medicines.

With these general observations we may now call attention to the construction, or what may be termed the anatomy, of the prescription itself—how it is put together, and how its component parts are arranged; and we shall commence with the character ℞ with which all prescriptions begin, and which really means an old invocation to Jupiter—or rather the straight mark across the tail of the ℞ is typical of the cloven foot of that heathen deity, and affords a striking illustration of how tenaciously modern civilization yet clings to some of the relics of pagan barbarism. From long habit or usage through many centuries it has been retained—we can scarcely tell why. To some it has no meaning; to others it may serve as a reminder of the remote origin of our noble profession, however enshrouded by the ignorance and superstition of a pagan world. And since it is a little thing, neither amounting to much nor affecting the virtues of the medicine which follows it, so we let it stand. But, conventionally, the character in question is held to imply the Latin verb *recipe*, which governs the quantity in the accusative, the name of the medicine being put in the genitive. Thus: recipe (take), pulveris (of powder), scammoniæ (of scammony), scrupulum (a scruple), would be a Latin prescription written in full; but generally the ingredients are more abbreviated, and the quantity, instead of being written, is expressed by symbols or signs. It is also the custom at the present time to write the directions as to the taking of medicine in plain English, though the names of the medicine retain their usual Latin form. All abbreviations in a prescription should be of such character as not only to be readily made out, but so evident as to afford no shelter to the druggist whose carelessness may lead to serious mistakes. In the case of alkaloids and other powerful remedies, the chief name at least should be written in full.

The symbols denoting the quantity of the ingredients should be distinctly given. The exact quantities for each dose, the periods for its repetition, and

any other directions necessary, should be given in full length, and in the plainest possible language.

Another rule of great importance, and one which, no doubt, has saved many lives, is, that no prescription should pass from the hands of the prescriber without being deliberately read over and its contents correctly ascertained.

A prescription, according to established usage, is generally divided into four parts.

1. The basis, the principal or most active ingredient.
2. The adjuvant, designed to promote the action of the former.
3. The corrigent, or that which is intended to correct or modify the operation of the basis.
4. The excipient or vehicle, which is the substance that gives the prescription consistence and form.

It is not, however, necessary that every prescription should be composed of these four constituents; in fact, very often the fewer ingredients in a prescription the better, if it will answer the purpose. Complexity should always be avoided, especially if the action of each article is not well understood.

The name of the patient for whom the prescription is made should be written at the top; and after the directions, at the lower left-hand corner, the date; and at the right-hand corner the name, or most usually the initials, of the prescriber. The modern prescription may be fashioned after the following illustration:

FORMS OF PRESCRIPTIONS.

Designation.	℞ Medicines.	Single Dose.	Multiplied by	No. of Doses.	Equals.	Gross Amount.
Basis	Ext. colocynth co.	grs. ij	×	10	=	℈ j
Adjuvans	Pil. hydrargyri	gr. j	×	10	=	grs. x
Corrigens	Ext. hyoscyami	gr. ½	×	10	=	grs. v
Vehicle	Syrupi simpl.	Q. S.	At option of the pharmacist.			

Ft. in Pil. No. X. Sig. One or two at bed-time.

Basis	℞ Hydrarg. chl. cor.	grs.1-16	×	16	=	gr. j
	Potassii iodid.	grs. 7½	×	16	=	ʒ ij
Adjuvans	Tr. cinchon. co.	ʒ j	×	16	=	℥ ij
Vehicle	Elixir simpl.	ʒ j	×	16	=	℥ ij

Whole amount is ℥ iv, divided by sixteen doses gives bulk of single dose one dessertspoonful. Sig. Dessertspoonful after meals.

Basis	℞ Iodoformi	grs. v	×	6	=	ʒ ss.
	Ol. eucalypti	grs. x	×	6	=	ʒ j
Adjuvans	Morphinæ sulphatis	gr. ⅛	×	6	=	grs. ij
Corrigens	Ceræ	grs. iv	×	6	=	grs. xxiv
Vehicle	Ol. theobromæ	grs. 30	×	6	=	ʒ iij

Make in six rectal suppositories. Sig. One night and morning.

Isaac Brown.

℞ Olei eucalypti.............................. ʒ ij.
Syrupi. morph. co.,
Syrupi tolu........................... āā ℥ jss.
M. S. Teaspoonful every four hours.
Sept. 1, 1883. A. B. C.

Geo. W. Briggs.

℞ Olei terebinthinæ,
Tincturæ opii......................... āā f ʒ iij.
Acaciæ,
Sacchari albi .... āā ʒ iij.
Aquæ menthæ.......................... f ℥ iij.
M. S. Teaspoonful every four hours.
Oct. 10, 1883. N. S. D.

John Smith.

℞ Iodoformi	ʒ ss.
Ex. belladonnæ	grs. iij.
Morphinæ sulph.	grs. ij.
Olei theobromæ	ʒ iij.

M. Ft. suppositoria No. VI.
S. One night and morning as directed.

Nov. 20, 1883. R. C. W.

RULES FOR GENITIVE-CASE ENDINGS IN PRESCRIPTION-WRITING.

I. Words ending in *a* form genitive (or prescription form ending) in *æ:* as morphina, morphinæ. Exceptions: *folia* (*foliorum*), and a few of Greek origin, as physostigma (physostigmatis), enema (enematis), cataplasma (cataplasmatis), gargarisma (gargarismatis).

II. All salt-names ending in *as*, by changing to *atis:* as sulphas (sulphatis), acetas (acetatis).

III. All words ending in *e*, *en*, *er*, *or*, *ur*, by adding *s* or *is:* as alōe (alōes), mite (mitis), alumen (aluminis), semen (seminis), æther (ætheris), sulphur (sulphuris).

IV. All salt-names ending in *is*, by changing to *itis:* as arsenis (arsenitis), and most botanic names to *idis:* as anthemis (anthemidis), colocynthis (colocynthidis), hamamelis (hamamelidis), iris (iridis), macis (macidis). Exception: pulvis (pulveris). Cannabis, digitalis, hydrastis, sinapis, have no change of form.

V. Words ending in *o*, by changing to *onis:* as confectio (confectionis), emulsio (emulsionis), lotio (lotionis), trituratio (triturationis), carbo (carbonis), pepo (peponis), sapo (saponis). Exceptions: mucilago (mucilaginis), ustilago (ustilaginis). Matico is *maticæ*, and *kino* and *condurango* have no change.

VI. Words ending in *on*, by changing to *i:* as hæmatoxylon (hæmatoxyli), erythroxylon (erythroxyli), toxicodendron (toxicodendri). Exceptions: erigeron (erigerontis), limon (limonis).

VII. Words ending in *um*, or *us*, by changing to *i:* as acidum (acidi), potassium (potassii), juniperus (juniperi), ulmus (ulmi). Exceptions: rhus (rhois). *Cornus*, *fructus*, *spiritus*, and *quercus* remain unchanged.

VIII. Words ending in *ax*, by changing to *acis:* as borax (boracis), styrax (styracis); those ending in *ex*, by changing to *icis:* as cortex (corticis), rumex (rumicis); other words ending in *x*, change to *cis:* as pix (picis), radix (radicis), salix (salicis), nux (nucis), calx (calcis).

IX. Words ending in *os*, by changing to *ris*, or *vis:* as flos (floris), bos (bovis); those ending in *c*, by adding *tis:* as lac (lactis); those in *al* and *ol*, by adding *is:* as chloral (chloralis), alcohol (alcoholis), thymol (thymolis), and a few in *el*, by adding *lis:* as fel (fellis), mel (mellis); those in *ns*, by dropping the *s* and adding *dis:* as juglans (juglandis); *eps* may change to *ipis:* as adeps (adipis). Words ending in *rs* may drop the *s* and form the genitive by adding *tis:* as pars (partis).

X. The following words remain unchanged: *Amyl*, *apiol*, *azedarach*, *buchu*, *cajuputi*, *catechu*, *coca*, *curare*, *elixir*, *jaborandi*, *kamala*, *sago*, *sassafras*, *sumbul*, and a few others, besides those specified that are regarded by authorities as indeclinable.

Latin idiom usually imposes a different *order of words* from what is the custom in English. Such a title as *sulphate of quinine* would in Latin have the words reversed in order, reading *of quinine the sulphate.* This order is followed in Latinizing titles of medicines, except that where the thing is a *pharmaceutical preparation*, the word signifying the kind of preparation—*tincture*, *extract*, etc., precedes its dependent as in English. Hence we have the incongruity of the titles *opii pulvis*—"powder of opium"—a *condition* of opium; but *tinctura opii*—"tincture of opium"—a *preparation* made

from the drug. In Latin, adjectives *follow* the nouns they affect, instead of *preceding*, as in English; and this idiom is commonly observed in pharmacal Latin. *Green soap* is, therefore, *sapo viridis; mild chloride* is *chloridum mite*, etc.

Symbols or Signs used in Prescriptions.

Gr. = Grain; gtt. = Drop; m = Minim; ℈ = Scruple; ʒ = Drachm; ℥ = Ounce; O = Pint; C = Gallon; ℔ = Pound.

Table of Apothecaries' Weight.

gr., Granum (*Grain*)	= a grain.
℈, Scrupulum (*Scruple*)	= 20 grains.
ʒ, dr., Drachma (*Drachm*)	= 60 grains.
℥, oz., Uncia (*Ounce Troy*)	= 8 drachms.
℔, Libra (*Pound*)	= 12 Troy ounces.

Measures by Capacity.

m., Minimum (*Minim*)	= $^1/_{60}$ part of fluidrachm.
gtt., Gutta (*Drop*)	= usually ½ minim.
fl ʒ, Fluidrachma (*Fluidrachm*)	= 60 minims.
fl ℥, Fluiduncia (*Fluidounce*)	= 8 fluidrachms.
O, Octarius (*Pint*)	= 16 fluidounces.
C, Congius (*Gallon*)	= 8 pints.

Approximate Measures.

A Drop = usually about ½ minim.
A Teaspoonful = 60 drops, f ʒ j.
A Dessertspoonful = f ʒ ij.
A Tablespoonful = f ℥ ss.
A Wineglassful = f ℥ ij.
A Teacupful = f ℥ iv.

Table to assist the Beginner in prescribing Liquids.

Having fixed upon the bulk of his liquid, he will remember that there are in

1 fluidounce, 8 Teaspoonfuls each 1 fluidrachm.
2 fluidounces, 15 Teaspoonfuls each 1 fluidrachm.
4 fluidounces, 30 Teaspoonfuls each 1 fluidrachm.
4 fluidounces, 15 Dessertspoonfuls each 2 fluidrachms.
6 fluidounces, 20 Dessertspoonfuls each 2 fluidrachms.
6 fluidounces, 12 Tablespoonfuls each ½ fluidounce.
8 fluidounces, 15 Tablespoonfuls each ½ fluidounce.
1 pint, 30 Tablespoonfuls each ½ fluidounce.
1 pint, 8 Wineglassfuls each 2 fluidounces.

The Roman Numerals are used.

ss. = ½; I = 1; II = 2; III = 3; IV = 4; V = 5; VI = 6; VII = 7; VIII = 8; IX = 9; X = 10; XX = 20; XXX = 30; XL = 40; L = 50; LX = 60; LXX = 70; LXXX = 80; XC = 90; C = 100.

The increase above ten is usually expressed by adding the symbols for the corresponding notation to X, thus: "13" = XIII; "18" = XVIII; twenties, thirties, etc., are expressed in a corresponding manner.

Scheme of the Metric or French Decimal System of Weights and Measures.

The metric system is based upon the METER, which is the standard unit of *length* of that system, and equal to 39·370432 inches, or about 10 per cent longer than the yard.

The metric unit of *fluid measure* is the LITER—the cube of $^1/_{10}$ meter, or 1,000 cubic centimeters—equal to about 34 fluidounces.

The metric unit of *weight* is the GRAM, which represents the weight of one cubic centimeter of water at its maximum density. It is equal to 15(·43234874) Troy grains.

One CUBIC CENTIMETER is equal to 16·231 minims.

The prefixes are simply numerals, as follows:

myria, which means 10,000.			*deci*, which means 0·1.	
kilo,	" "	1,000.	*centi*, " "	0·01.
hecto,	" "	100.	*milli*, " "	0·001.
deka,	" "	10.		

and are quite unnecessary in the writing of prescriptions (if not in all cases), English numerals being more convenient, and at least equally explicit.

In writing prescriptions it is sufficiently accurate and safe to consider 1 gram as exactly equal to 15 Troy grains, and to consider 1 cubic centimeter as an equal to 15 minims. We accordingly have:

1 gram equal to $^{15}/_1$ Troy grains.
1 Troy grain equal to $^1/_{15}$ gram.
1 cubic centimeter equal to $^1/_4$ fluidrachm.
1 fluidrachm equal to $^4/_1$ cubic centimeter.

In writing prescriptions, the "gram" (abbreviated "Gm.") and "cubic centimeters" (abbreviated "C. C.," which may be called "fluigram," and written "f. Gm.") only should be used.

All other terms, and units, and prefixes, used in the metric system, may be wholly ignored by the physician and the pharmacist.

Example of a metric prescription:

℞ Hydrarg. chloridi corros........... 0|25 Gm.
Potassii iodidi..................... 10|00 Gm.
Aquæ............................ 100|00 C. C.
Tinct. cinch. comp. .... 100|00 C. C.
Mix.

The use of a decimal line prevents possible errors.

To write a prescription for fifteen doses of any medicine, write it first for *one* dose in *grains* and *minims*, and then substitute the same number of "grams" and "fluigrams," thus:

℞ Opii.............................. gr. j.
Camphoræ......................... gr. ij.
Make one pill.

And to get fifteen such doses in metric terms, write:

℞ Opii.............................. 1 Gm.
Camphoræ........................ 2 Gm.
Make fifteen pills.

This is a valuable *metric point* when making use of a *two-ounce* mixture. In such prescriptions we are only required to remember that the number of grains ordered of any medicament should be exactly the dose in minims or grains of the medicine. In other words: since 15 grains or minims equal one gram, and there are 15 teaspoonfuls in a two-ounce mixture, we simply write the same number of "grams" of a remedy that we wish grains or minims administered in each *teaspoonful* of the mixture. This remarkable coincidence reduces metric prescription-writing to great simplicity, as no arithmetical calculation is required to properly apportion the quantity of a drug after once knowing its dose in grains and minims.

℞ Quininæ sulphatis .... 5 Gm.
Acidi hydrobromic................. 20 Gm.
Fl. extract ergot.................. 10 Gm.
Elix. glycyrrhiz.......... q. s., ad. 64 Gm.
M. S. Teaspoonful every four hours.

In short, we actually substitute grams for minims and grains. If we wish to order a *four-ounce* mixture, we simply write *double* the quantity of grams that the dose of the medicine is in grains or minims.

Physicians and pharmacists use only weights and fluid measures. The following contains all that is essential of the metric weights and fluid measures:

1 Kilogram, equal to 1,000 grams.
1 Liter, equal to 1,000 fluigrams.

As one United States fluidrachm weighs very nearly one drachm (really only 57·047 Troy grains), it is customary to use the terms "drachm" and "fluidrachm," "ounce" and "fluidounce," almost indiscriminately, thus saying "an ounce of water" when *a fluidounce of water* is meant, etc. In the metric system "one *liter* of water," and "one *kilogram* of water," is actually the same quantity; and "one *gram* of water" is just "one *cubic centimeter* of water." It is, therefore, exceedingly convenient to drop the term *cubic centimeter*, and to give to it the name *fluigram* instead, so as to show at once the intimate relationship between the *gram* and *fluigram*.

For all practical purposes in medicine and pharmacy, it is perfectly proper to ignore the interminable fractions given above in comparing the metric units with those of the old system. The difference is, in fact, so insignificant that it would be absurd to suppose that any therapeutic objection exists against ignoring it. Thus, the metric units compare with the old units, and *vice versa*, as follows:

1 Gram is equal to 15 Troy grains.
1 Troy grain is equal to $^1/_{15}$ gram.
1 Fluigram is equal to 15 minims.
1 Minim is equal to $^1/_{15}$ fluigrams.

Or,

1 Drachm is equal to 4 grams.
1 Gram is equal to $^1/_4$ drachm.
1 Fluidrachm is equal to 4 fluigrams.
1 Fluigram is equal to $^1/_4$ fluidrachm.

Oscar Oldberg, Phar. D., suggests that if now the *centigram* be called a "cent," and the *milligram* a "mill," and if we call the tenth part of one *fluigram* a "fluidime," we will then have an Americanized Metric System of Weights and Measures, such as it will be very easy to learn, viz.:

Weights.

1 Kilogram, equal to 1,000 grams.
1 Gram, equal to 100 cents, or 1,000 mills.

Measures.

1 Liter, equal to 1,000 fluigrams.
1 Fluigram, equal to 10 fluidimes, or 100 fluicents, or 1,000 fluimills.

(As 1 fluidime is equal to only 1½ United States minim, a smaller unit for fluid measures would be useless.)

In writing metric quantities, it is most convenient to spell and abbreviate as follows:

Spell.	*Abbreviate.*
Meter (not metre).	
Liter (not litre).	
Cubic centimeter (not metre).	C. C.
Gram (not gramme).	Gm.
Fluigram (not gramme).	fGm.
Fuidime.	fD.

RULES FOR CONVERSION.

1. To convert Troy grains into cents (centigrams):
Multiply by 6.
2. To convert cents (centigrams) into Troy grains:
Divide by 6.

3. To convert Troy grains into mills (milligrams):
Multiply by 60.
4. To convert mills (milligrams) into Troy grains:
Divide by 60.
5. To convert Troy grains into grams, or minims into fluigrams:
Divide by 15.
6. To convert grams into grains, or fluigrams into minims:
Multiply by 15.
7. To convert drachms into grams, or fluidrachms into fluigrams:
Multiply by 4.
8. To convert grams into drachms, or fluigrams into fluidrachms:
Divide by 4.

Physicians desiring to write metric prescriptions, might readily remember that:

1 Troy grain is equal to 6 cents.
1 Drachm is equal to 4 grams.
1 Troy ounce is equal to 30 grams.
1 Minim is equal to $^1/_{16}$ fluigram.
1 Fluidrachm is equal to 4 fluigrams.
(1 Drop is equal to about $^1/_2$ fluidime.)

The average "Drop" is about 0·05 fGm.
A Teaspoonful is about 5 fGm.
A Dessertspoonful is about 10 fGm.
A Tablespoonful is about 20 fGm.
A Wineglassful is about 75 fGm.

The above contains *all that is necessary to know or learn* of the metric system *in order to write metric prescriptions*, without a metric posological table, or with one.

To become familiar with the system, the rules given above for the conversion of apothecaries' weights and measures into the corresponding metric quantities may be profitably used.

It is thought by many medical men that the adoption of the metric system of weights and measures is a matter of time only. The U. S. Marine Hospital Service adopted it in 1878, and the Medical Department of the U. S. Navy in 1881. Its advantages over other systems are well recognized.

List of Abbreviations used in Prescriptions.

āā = *Ana* = Of each.
Ad. = *Adde* = Add.
Ad lib. = *Ad libitum* = At pleasure.
Aliquot = Several, some.
Bis in die = Twice a day.
Chart = *Chartula* = Small paper.
Coch. = *Cochleare* = Spoonful.
" { Amplum, or Magnum } = Tablespoonful.
" Medium = Dessertspoonful.
" Minimum = Teaspoonful.
Cochleatim = By spoonful.
Collyr. = *Collyrum* = Eyewater.
Cyanth. = *Cyanthus* = Wineglassful.
D. = *Dosis* = Dose.
Div. = *Divid* = Divide.
Don. = *Donec* = Until.
Ejusdem = Of the same.
Fl. = *Fluidum* = Fluid.
Ft. = *Fiat* = Make.
Grad. = *Gradatim* = Gradually.

Guttatim = Drop by drop.
Haus. = *Haustus* = A draught.
Hor. alt. = *Horis alternis* = Every other hour.
H. s. = *Hora somni* = At bed-time.
Ind. = *Indies* = Daily.
Lag. = *Lagena* = A bottle.
M. = *Misce* = Mix.
Mass. = *Massa* = Mass.
Manip. = *Manipulus* = Handful.
Mist. = *Mistura* = Mixture.
No. = *Numero* = To the number of.
Phiala = A vial or phial.
Pil. = *Pilula* = Pill.
Post cibum = After eating.
P. r. n. = *Pro re nata* = According to circumstances, occasionally.
Pulv. = *Pulvis* = A powder.
Q. s. = *Quantum sufficiat* = Sufficient quantity.
Q. v. = *Quantum vis* = As much as you choose.
Q. in d. = *Quater in die* = Four times a day.
Quotidie = Daily.
Q. h. = *Quaqua hora* = Every hour.
℞ = *Recipe* = Take.
Semihora = Half an hour.
Sesquihora = An hour and a half.
Sig. = *Signa* = Write.
ss. = *Semis* = Half.
Statim = Immediately.
Subinde = Now and then.
T. in d., or T. d. = *Ter in die* = Three times a day.
Troch. = *Trochischus* = A troche.
Trit. = *Tritura* = Triturate.
Ter sim. = *Tere simul* = Rub together.
Ungt. = *Unguentum* = An ointment.
Vin. = *Vinum* = A wine.
Vehic. = *Vehiculum* = A menstruum.
Vit. = *Vitelus* = The yolk of an egg.

TABLE I.

Table of Solubility.

B. = *Boiling*; C. = *Cold*; H. = *Hot*; Part. = *Partially*; Rdy. = *Readily*; S. or Sol. = *Soluble*; Spg. = *Sparingly*.

MEDICINES.	In Water.	In Alcohol.
Acidum arseniosum.	Sol. 1 in 100 C. 20 B.	Insoluble.
benzoic.	Sol. 1 in 500 C. 25 B.	Rdy. Sol.
boracic.	Spg. Sol.	Sol. 1 in 6.
carbolic.	Rdy. Sol.	Rdy. Sol.
crysoph.	Spg. Sol.	Sol. in B.
citric.	Sol. 4 in 3 C. 2 H.	Rdy. Sol. 80 per cent.
gallic.	Sol. 1 in 20 C. 3 H.	Rdy. Sol.
salicylic.	Sol. in H.	"
tannic.	Rdy. Sol.	Soluble.
tartaric.	Sol. 1 in 2 C. 1 H.	Rdy. Sol. 80 per cent.
thymic.	Sol. 1 in 330.	Rdy. Sol.
Aconitia.	Sol. 1 in 150 C. 50 B.	"
Æther.	Sol. 1 in 10.	Miscible.
Aloin.	Sol. 1 in 60 C. 5 B.	Rdy. Sol.
Alumen.	Sol. 1 in 12 C. 5 in 4 B.	Insoluble.

TABLE OF SOLUBILITY.—(*Continued.*)

MEDICINES.	In Water.	In Alcohol.
Ammonii acetas.	Soluble.	Soluble.
bromid.	Rdy. Sol.	Spg. Sol.
carbonas.	Sol. 1 in 4.	"
chlorid.	Sol. 1 in 3 C. 1 B.	Soluble.
iodid.	Rdy. Sol.	Rdy. Sol.
valerian.	"	"
Amyli nitrite.	Spg. Sol.	"
Antimonii, et pot. tart.	Sol. 1 in 15 C. 2 B.	Insoluble.
Apiol.	Insoluble.	Rdy. Sol.
Apomorphina.	Soluble.	Soluble.
Argenti nitras.	Sol. 1 in 1½.	S. 1 in 10 C. 4 B.
Arsenici chlorid.	Rdy. Sol.	Rdy. Sol.
iodidum.	Sol. 1 in 6 C. 3 B.	Sol. in B.
Atropina.	Sol. 1 in 200 C. 50 B.	Rdy. Sol.
sulphas.	Rdy. Sol.	"
Berberina.	Rdy. Sol. in B.	"
sulphas.	Spg. Sol.	"
Brominium.	Sol. 1 in 34.	Soluble.
Caffein.	Rdy. Sol. in H.	Sol. 1 in 20.
citras.	Soluble.	Soluble.
Calcii carb. præc.	Spg. Sol.	Insoluble.
chlorid.	Sol. 1 in 2.	Rdy. Sol.
hypophos	Sol. 1 in 6.	Insoluble.
hyposulph.	Rdy. Sol.	"
iodidum.	"	Soluble.
chlorinata.	Part. Sol.	Spg. Sol.
Camphora.	Sol. in 1,000.	Rdy. Sol.
Chenoidin.	Sol. in 1,500 C. 75 B.	Sol. in 45 C. 4. B.
Chloralhydrate.	Rdy. Sol.	Rdy. Sol.
Chloroform.	Insoluble.	Sol. 10 in 6.
Cimicifugin.	"	Rdy. Sol.
Codia.	Sol. 1 in 100 C. 50 B.	"
sulphas.	Rdy. Sol. in H.	"
Colchicin.	Spg. Sol.	"
Colocynthin.	Insoluble.	Sol. in H.
Conia.	Spg. Sol.	Rdy. Sol.
sulphas.	Rdy. Sol.	"
Copaibæ resin.	Insoluble.	Soluble.
Cornin.	Rdy. Sol.	Rdy. Sol.
Creasotum.	Sol. in 80 C. 24 H.	Miscible.
Cupri sulphas.	Sol. 1 in 3.	Insoluble.
Daturia.	Insoluble.	Soluble.
Delphiniin.	Spg. Sol.	Rdy. Sol.
Digitalinum	"	"
Duboisin.	Part. Sol.	"
Elaterinum.	Insoluble.	"
Emetia.	Sol. in H.	"
Ergotina.	Insoluble.	"
Eucalyptol.	Insoluble.	Sol. to a certain extent.
Ferri acetas.	Rdy. Sol.	Spg. Sol.
amm. chlor.	Soluble.	
chlorid.	Sol. 1 in 3.	Insoluble.
bromid.	Soluble.	Soluble.
chlorid.	Rdy. Sol.	"
citras.	"	Spg. Sol. in Dil.
et ammon.		
" citras.	Sol. 2 in 1.	Insoluble.
" tart.	Sol. 2 in 3.	"
" sulph.	Sol. 1 in 3.	"
magnes. cit.	Soluble.	"

TABLE OF SOLUBILITY.—(*Continued.*)

MEDICINES.	In Water.	In Alcohol.
Ferri pot. tart.	Spg. Sol.	Insoluble.
quin. cit.	Sol. 2 in 1.	"
strych. cit.	Rdy. Sol.	Sol. in Dil.
hypophosph.	Spg. Sol.	Spg. Sol.
iodidum.	Sol. 1 in 1.	Soluble.
lactas.	Sol. in 45. C. Rdy. B.	Sol. 1 in 70.
subsulph.	Soluble.	
sulphas.	Sol. 2 in 3.	Insoluble.
tartras.	Sol. 1 in 4.	Spg. Sol.
valerianas, etc.	Insoluble.	Soluble.
redactum..	Spg. Sol.	Insoluble.
Guaiaci resin.	Part. Sol.	Rdy. Sol.
Hamamelin.	Part. Sol.	Sol. in Dil.
Humulin.	Sol. 1 in 20 H.	Rdy. Sol.
Hydrastin.	Insoluble.	Sol. in B.
Iodinium.	Spg. Sol.	Rdy. Sol.
Irisin.	Insoluble.	"
Jalapin.	Soluble.	"
Leptandrin.	Insoluble.	Soluble.
Lithii benz.	Rdy. Sol.	Sol. 1 in 12.
bromid..	"	Soluble.
citras.	Sol. 2 in 5.	"
Lupulina.	Sol. 1 in 20 H.	Rdy. Sol.
Magnes carbonas.	Spg. Sol.	Insoluble.
citras.	Rdy. Sol.	Spg. Sol.
sulphas.	"	Insoluble.
Manganesii iodidum.	"	Soluble.
sulphas.	Sol. 10 in 13.	Insoluble.
Morphina.	Spg. Sol.	Sol. 1 in 30 B.
acetas.	Sol. 1 in 17 C. 1 B.	Sol. 1 in 44 C. 1 B.
hydrochloras.	Soluble.	Sol. in H.
sulphas.	Rdy. Sol.	Rdy. Sol.
Narceia.	Sol. in B.	"
Pilocarpina.	Part. Sol.	Rdy. Sol.
hydrochloras.	Soluble.	"
Piperina.	Insoluble.	Sol. 1 in 30 H. 1 C.
Plumbi acet.	Sol. 2 in 5.	Spg. Sol.
Potassa.	Sol. 2 in 1.	Soluble.
Potassii acetas.	Sol. 3 in 3 C. 1. B.	Sol. 1 in 3.
bicarbon.	Sol. 2 in 8 C. 3 B.	Insoluble.
bichrom.	Sol. 1 in 10 C.	"
bitart.	Sol. 1 in 240 C. 16 B.	"
bromid.	Sol. 1 in 3 C. 1 B.	Soluble.
carbonas.	Sol. 4 in 3.	Insoluble.
chloras.	Sol. 1 in 12 C. 2 B.	Sol. in Dil.
citras.	Sol. 5 in 3.	Insoluble.
cyanid.	Rdy. Sol.	"
et sodii tart.	Sol. 1 in 5.	Part. Sol.
ferrocyan.	Sol. 1 in 3 C. 1 B.	"
hypophos.	Rdy. Sol.	"
hyposulph.	"	Insoluble.
iodidum.	Sol. 4 in 3.	Sol. 1 in 6.
nitras.	Sol. 2 in 8 C. 5 B.	Insoluble.
permang.	Sol. 1 in 16.	Decomposed.
salicylas.	Rdy. Sol.	Rdy. Sol.
sulphas.	Sol. in 10 C. 4 B.	Spg. Sol.
tartras.	Sol. 5 in 4.	Insoluble.

TABLE OF SOLUBILITY.—(*Continued.*)

MEDICINES.	In Water.	In Alcohol.
Quassiin.	Spg. Sol.	Rdy. Sol.
Salicin.	Rdy. Sol.	Rdy. Sol.
Santonin.	Rdy. Sol. in H.	Rdy. Sol. in H.
Sodii acetas.	Sol. 3 in 9 C. 6 B.	Spg. Sol.
arsenias.	Sol. 2 in 7.	Sol. 1 in 60 B.
bicarbon.	Sol. 1 in 10.	Spg. Sol.
boras.	Sol. 1 in 20 C. 2 B.	Insoluble.
bromid.	Sol. 1 in 2.	Sol. in Dil.
carbonas.	Sol. 1 in 2.	Insoluble.
chlorid.	Sol. 2 in 5.	Sol. in Dil.
hypophos.	Rdy. Sol.	Soluble.
hyposulph.	"	Insoluble.
iodidum.	Sol. 17 in 10.	Spg. Sol.
nitras.	Sol. 1 in 2.	"
phosphas.	Sol. 1 in 5.	"
salicylas.	Rdy. Sol.	"
sulphas.	Sol. 1 in 3.	Insoluble.
sulphis.	Sol. 1 in 4.	"
sulpho-carbol.	Rdy. Sol.	Rdy. Sol.
Strychnina.	Insoluble.	Insoluble.
acetas.	Rdy. Sol.	Rdy. Sol.
sulphas.	Sol. 1 in 42 C. 1. B.	Sol. 1 in 82 C. 1 B.
Svapnia.	Soluble.	Soluble.
Sulphur.	Insoluble.	Spg. Sol.
iodidum.	"	Decomposed.
Veratria.	"	Rdy. Sol.
Viburnin.	Part. Sol.	"
Woorara.	Soluble.	Soluble.
Xanthoxylin.	Insoluble.	Rdy. Sol.
Zinci acetas.	Sol. 2 in 5.	Sol. 1 in 30.
chloride.	Sol. 5 in 2.	Sol. 1 in 2.
iodidum.	Rdy. Sol.	Rdy. Sol.
sulphas.	Sol. 10 in 7.	Insoluble.
valerianas.	Sol. 1 in 50 C. 40 B.	Sol. 1 in 60.

It must be borne in mind that while some substances are completely soluble in a hot or boiling solution, they are partially precipitated when the solution cools.

TABLE II.

INSOLUBLE (OR NEARLY SO) IN BOTH WATER AND ALCOHOL; WHAT SOLUBLE IN.

MEDICINES.	Dissolved by
Acidum arsen.	All acids.
benzoic.	Readily soluble in aqueous solution, 1½ pts. phosphate or 4 pts. sulphate of sodium.
Amyli iodid.	Diluted acids, acidulated water. Acetic acid best.
Argenti cyanidum.	Aqueous solutions of cyanide of potass. or sodium, chloride of ammonia, hyposulphite of sodium, aqua ammonia.
iodidum.	Aqueous solution of cyanide of potass., alkaline solution of chlorides or iodides.
oxidum.	Aqueous solution of ammonia, solutions of the alkaline hypophosphites, chlorides, and cyanides.

INSOLUBLE (OR NEARLY SO) IN BOTH WATER AND ALCOHOL; WHAT SOLUBLE IN.—(*Continued.*)

MEDICINES.	Dissolved by
Auri cyanid.	Aqueous solution cyanide potass.
Bismuthi cit.	Readily soluble by addition of aqueous solution of ammonia, drop by drop.
subcarb.	Aqueous solution of carbonate of ammonia, muriatic and nitric acids.
subnit.	Dil. nitric acid.
Brucia.	Carbonic-acid water. The salts freely soluble in glycerine.
Calx.	More readily dissolved by addition of sugar.
Calcii carb. præc.	Cold aqueous solution chlor. ammon.
phosphas.	Solution chloride ammonia, dil. phosphoric acid.
Cantharidin.	Benzoic and hot acetic acids, boiling oil of turpentine.
Cerii oxalas.	Aqueous solution of chloride ammonia, excess of muriatic acid. Decomposed by nitric acid.
Cinchonia.	Excess of sulphuric acid.
sulphas.	" " "
Cinchonidia.	" " "
sulphas.	" " "
Creta præp.	Muriatic and other acids.
Cubebin.	Acetic acid, fatty and essential oils.
Ferri arsen.	Muriatic and nitric acids.
carbonas.	Aqueous solution of chloride ammonia, carbonic-acid water, muriatic acid.
" præc.	Aqueous solution of chloride ammonia, carbonic-acid water, muriatic acid.
" sacch.	Muriatic and other acids.
ferrocyan.	Oxalic acid, concentrated solution of sulphuric acid.
hypophos.	Muriatic acid.
phosphas.	Hot muriatic acid, aq. ammonia.
pyrophos.	Phosphoric and citric acids.
Hydrargyrum.	All the soluble salts, when rendered soluble, become more or less decomposed, generally into a more poisonous salt.
ammoniat.	Nitric and muriatic acids, aqueous solutions of nitrate, acetate or sulphate of ammonia.
cum creta.	Muriatic acid.
iodid. rub.	Aqueous solution iodide potass.
" vir.	Muriatic acid. Partially (by decomposition) in solution of iodide of potass.
nitras.	Muriatic, nitric, or sulphuric acid, aqueous solution of ammonia or nitrate of ammonia.
sulphas flav.	Dil. sulphuric acid, solution of sulphate of potass. or sodium.
Ingluvin.	Muriatic acid added to water.
Iodoformum.	Soluble in 7 pts. ether, fixed volatile oils. Water precipitates it from alcoholic solution.
Lithii carbon.	Carbonic-acid water, aqueous solution of ammoniacal salts.
Magnesii carbon.	Carbonic-acid water, cold aqueous solution chloride ammonia.
Manganesii phosphas	Sulphuric acid.
Myricin.	Ether, naphtha, oil of turpentine.
Pepsin.	Water, acidulated with muriatic acid.
Phosphorus.	Sulphide of carbon best, 1 in 20 absolute ether

INSOLUBLE (OR NEARLY SO) IN BOTH WATER AND ALCOHOL; WHAT SOLUBLE IN.—(*Continued.*)

MEDICINES.	Dissolved by
Plumbi carbon.	Acetic acid, aqueous solution acetate or chloride ammonia.
iodidum.	Hydriodic acid.
nitras.	Dil. nitric acid.
oxidum.	Nitric and muriatic acids, boiling solution acetate of lead.
Podophyllin.	Dissolves with combination in aqueous solution of caustic alkalies.
Quinina.	Acidulated waters.
sulphas.	Glycerine, sulphuric acid.
Quinidia.	Acidulated waters.
Strychnina.	Dil. and weak acids, essential oils, soluble 1 in 100 pts. weak alcohol.
Sulphur.	Chloroform, naphtha, oil of turpentine.
iodidum.	Glycerine.
Zinci carbon.	Acids, warm aqueous solution chloride of ammonia.
oxidum.	Acids.
phosphas.	Phosphoric acid.

Glycerine approaches very nearly to diluted alcohol as a solvent, dissolving all deliquescent salts, several metallic salts, as the nitrates, chlorides and sulphates, the alkalies and several metallic oxides, and many vegetable acids. A high temperature greatly increases its solvent power.

Alcohol is miscible in all proportions with water, wood, spirits, chloroform, and ether. It is a good solvent for resins, ethers, essential oils, fats, and alkaloids, especially when hot in the case of the latter.

Ether dissolves many organic compounds, as volatile oils, resins, fats, alcohol, and most of the alkaloids.

INCOMPATIBLES AND ANTAGONISTS.

Incompatibles may be divided into three divisions, viz.:

I. *Chemical*—where substances so combine as to be inert (but may not be therapeutically so) or have distinct properties.

II. *Pharmaceutical*—a combination of substances which are physically incapable of mixing.

III. *Physiological and Therapeutical* (*Antagonists*)—a combination of substances which possess opposite therapeutical or physiological properties.

LAWS OF CHEMICAL INCOMPATIBILITY.

I. Two salts in solution may form, by the interchange of their acids and bases, two insoluble salts which are precipitated, or a soluble and insoluble salt; the latter will generally be precipitated, or may form with the soluble salt a double salt.

II. When two salts in solution do not give rise to an insoluble salt, no precipitate will result, though there may be decomposition.

III. An acid will decompose a salt:

(*a*) If the acid added be more fixed or more soluble than that of the salt.

(*b*) If the acid added can form an insoluble or less soluble compound with the base of the salt.

(*c*) If the acid added possesses a greater affinity for the base of the salt.

(*d*) If the acid of the salt be gaseous.

IV. *Soluble salts* which can, by mutual decomposition, form an insoluble compound, will undergo such decomposition when they meet in solution, and will precipitate, unless in some very rare instances, in which a double salt is formed.

V. *Soluble salts* which are not capable of forming an insoluble salt never precipitate, and rarely undergo decomposition when they meet in solution.

VI. *Mineral acids* decompose salts of the weaker acids (carbonic, acetic, etc.), and form ethers with alcohol and alcoholic preparations.

VII. *Alkalies* precipitate the alkaloids and the soluble non-alkaline metallic salts.

VIII. *Glucosides*, such as santonine and colocynthin, should not be prescribed with free acids or emulsion.

IX. *Tannic acid*, and all substances containing it, are incompatible with alkaloids and drugs containing them, with albumen and gelatine, and with most soluble metallic salts used in medicine.

X. *Iodine* and soluble *iodides* are incompatible with the alkaloids and the substances containing them, as well as most of the metallic salts. The *iodide of potassium* should always be prescribed alone, or only in combination with corrosive sublimate (with which it forms a double salt), or with iodine itself.

XI. *Tinctures*, and *alcoholic preparations* containing resin, precipitate the latter when water is added.

XII. *Nitrate of silver* should always be prescribed alone, or in combination with opium only. Most vegetable extracts decompose it.

XIII. *Corrosive sublimate* is incompatible with almost everything, and should be given in simple syrup; even the compound syrup of sarsaparilla is said to decompose it.

XIV. *Syrup of squill* is incompatible with carbonate of ammonium on account of the acetic acid which it contains.

XV. *Acetate and subacetate of lead* are incompatible with almost everything, but may be used with opium, the resulting compound being therapeutically active.

XVI. *Vegetable infusions* are generally incompatible with metallic salts.

XVII. *Acacia* precipitates with alcohol, and vegetable and metallic astringents and mineral acids.

EXPLOSIVE PRESCRIPTIONS.

In this connection it is of the utmost importance to call attention to a list of substances which have been found to produce explosive mixtures or prescriptions, and are often attended with serious accidents; but only such as are in common use will be mentioned.

I. *Chlorate of potassium* and all other *chlorates* should never be prescribed in powder mixed with organic or inorganic, combustible or oxidizable bodies. If the chlorates are to be used in powder, prescribe them alone. If desired in combination, employ them in solution with others. The following mixtures, for example, are dangerous, and have caused serious accidents, namely: Potassii chloras and pulv. gallæ, or acid. tannic., equal parts mixed in powder for use as a gargle. These ingredients should always be dispensed separately; also potassii chloras and pulv. catechu, in equal proportions, ordered as a dentifrice, should not be dispensed; neither should chlorate of potassium and sodii (or calcii) hypophosphas be rubbed together, as an explosion will result. They should be dissolved separately in water and mixed. And a mixture of potassii chloras, tannic acid, glycerine, and water should be prepared by first dissolving the tannic acid in glycerine, and the chlorate of potassium in water, and then mixing. Do not attempt to rub the potassii chloras, tannin, and a portion of the glycerine together. And so, too, a mixture of potassii chloras, tr. ferri chloridi, and glycerin, in equal or other proportions, is liable to produce an explosive mixture, especially when warmed.

II. *Potassii permanganas* should never be brought in contact with any oxidizable and combustible substance. One of the most common mistakes is to bring it together with glycerin. This generally produces an explosion, as, for example:

℞ Potassii permanganatis..........	ʒj.
Glycerini.................	℥ss.

Nevertheless, this may be combined, but the resulting product will not possess the energetic oxidizing action of the permanganate, because it has expended all its powers in oxidizing the glycerin. If the glycerin be added very slowly, only flashes will rise from the mixture, which is finally turned black.

A mixture of potassii permanganas, alcohol, and water, in nearly equal proportions, in a closely stoppered phial, will almost always explode. The following prescription is dangerous:

℞ Potassii permanganatis.................. grs. x.
Ferrum reducti.......................... ʒ ss.
M. Ft. pil. No. XXXVI.

In this prescription the ingredients will take fire during mixing. Explosions will also occur if the permanganate of potassium is triturated with any of the *salts of morphine.*

III. *Chromic acid* is another agent which will readily part with its oxygen. Hence, the following prescription, for example, is dangerously explosive:

℞ Acidi chromici.................. grs. x.
Glycerini .... ʒj

IV. *Potassii bichromas* should not be prescribed with spts. ætheris nitrosi, as it also produces an explosive mixture.

V. *Oleum terebinthinæ* and other *volatile hydrocarbons* are liable to ignite, and to explode by coming in contact with certain powerful reagents. Thus, a mixture of ol. terebinth. and sulphuric acid has, on several occasions, been the cause of violent explosions and serious accidents, and it may also cause explosions with nitric acid. It is also acted upon energetically by iodine producing substitution products and liberating hydrogen gas, which may take fire during the violence of the reaction.

VI. *Iodine* is sometimes explosive when combined with *ammonia.* The following prescription is said to have exploded, owing to the formation of *nitrogen iodide,* there being considerable ammonia with the comp. camph. liniment:

℞ Iodi............................ ʒ ss.
Lin. camph. co. }
" saponis } .... āā ℥ ij.
M. Ft. liniment.

Also, if combined in certain proportions with hydrargyrum ammoniatum and lard to form an ointment.

VII. *Nitrate of silver* with *creosote* is explosive, and pills made with the *oxide* of silver in combination with hydrochlorate of morphine and extract of gentian, and covered with silver-foil, have exploded in a short time after they were made, setting fire to the patient's dress, and producing other injury. The nitrate and oxide of silver, when made into pills with saccharine and other reducing agents, do not, as a rule, explode with violence, but cause the pills to swell up rapidly and fall to pieces.

VIII. The undiluted *mineral acids,* in combination with alcoholic tinctures, are explosive. The combination of equal parts of nitric and muriatic acid with tincture of nux vomica has exploded in two hours after mixing. Cases are on record where a combination of nitro-muriatic acid, two parts, and tincture of cardamom, one part, has exploded in two hours after mixing, doing serious injury.

IX. *Collodion* with glycerin forms an explosive mixture, especially if the phial is agitated in a warm room or near a hot stove. Such a combination may prove dangerously explosive, as it embodies the elements of nitroglycerin.

Elegant Preparations.

Various expedients for disguising the unpleasant taste of valuable remedies are now rapidly growing in public favor, and in the administration of

such agents, especially to delicate women and children, it is by no means unimportant that they be dispensed in a palatable and elegant form.

The basis of such preparations most commonly used is the *simple elixir*, which is usually kept on hand in quantity, so that its various combinations can be made up as required, it being unnecessary to keep large quantities of any but those in most common use.

Flavoring Mixture.

℞ Oil of orange	℥ iv.
" caraway-seed } " coriander " }	āā ʒ ij.
" cinnamon } " anise }	āā ʒ j

Mix the oils, and dissolve them with enough alcohol to make a twenty-ounce mixture.

This *flavoring mixture* is used in making "*simple elixir*" and *flavored syrup.*

Simple Elixir.

℞ Flavoring mixture	1 ounce.
Alcohol	38 ounces.
Water	4½ pints.
Sugar (avoir. weight)	2½ pounds.
Carbonate of magnesia	½ ounce.

"Add two ounces of the alcohol to the flavoring mixture, and rub in a mortar with the carb. magnesia. Mix the balance of the alcohol with the water, and filter with the magnesia and flavoring mixture; then dissolve in the filtrate the sugar by agitation, and filter the whole through the same filter to make the preparation clear and brilliant. If desired to flavor the elixir more, it can readily be done by using more of the flavoring mixture, and, if necessary, a corresponding amount of carb. magnesia. This elixir will keep perfectly for any length of time, is improved by age, and may be used as the base in the same manner as water is used in dissolving salts, diluted alcohol in making tinctures, or simple syrup in making syrups." It is sometimes called cordial elixir, Curaçoa cordial, etc.

Flavored Syrup.

℞ Flavoring mixture	1 ounce.
Carb. magnesia	½ ounce.
Water	4 pints.
Sugar (avoir. weight)	8 pounds.

"Rub the flavoring mixture with the carb. magnesia in a mortar, and gradually add two pints of water, rubbing thoroughly, filter, and add the balance of the water through the filter. Put the sugar in a percolator, and percolate with the filtrate until completely dissolved."

By keeping on hand this flavored syrup, most of the preparations can be made in a moment by simply adding the required salts or solutions, and it is hardly desirable to keep them on hand in large quantities.

The beauty of a syrup depends upon its brilliancy and clearness. A syrup may be strained through flannel or muslin, or can be slowly filtered through cotton or paper. Straining is usually sufficient.

Most syrups are better made cold, and it will be found much less troublesome to make them so than to employ heat. Made in this manner, they keep better, and never crystallize.

The flavored syrup can be used with advantage as a base for the officinal syrups, and should be used in place of simple syrup. As it keeps better than the latter, and being nicely flavored, it presents a fair vehicle for administering unpleasant drugs.

The following list of important drugs may be combined with the "sir

elixir," so that each fluidrachm of the elixir will contain the stated number of grains, or minims:

Potassii acetas	grs. x.	Liq. potass. arsenitis	♏ v.
" bromidum	" x.	Chloroform	" v.
" iodidum	" v.	Fl. ext. gelsemium	" v.
" chloras	" ij.	" guarana	" x.
Chloralhydrate	" v.	" nux vomica	" v.
Atropinæ sulphas	" 1/64	" ipecac	" j.
Strychninæ sulphas	" 1/64	" damiana	" x.
Ammonii bromidum	" v.	" grindelia	" x.
Calcii bromidum	" v.	" pilocarpus	" x.
Ferri bromidum	" iij.	" gentian	" x.
Morphinæ bromidum	" 1/8	" rubus	" x.
Quininæ bromidum	" j.	" cinchona	" x.
Sodii bromidum	" x.	" podophyllum	" x.
Ferri pyrophosphas	" ij.	Tr. cannabis Indica	" xx.
Caffeini citras	" 1/8	" digitalis	" xv.
Lithii citras	" ij.	" belladonna	" vii.
Cinchonidinæ sulphas	" j.	" lobelia	" xv.
Svapnia	" j.	" opii deod	" x.
Tart. ant. et potass	" 1/8	" scilla	" xv.
Hydrarg. bichloridum	" 1/8	" veratrii viridis	" ij.

Also many other drugs may be thus given, either alone or in combination with other agents, as may be suggested, to meet the requirements of individual cases; and instead of using the simple elixir, the flavored syrup can be used when desired.

SOLUTIONS.

It is often an advantage for physicians and druggists to keep on hand certain important solutions as may be wanted to combine with other preparations; they can be used quickly and conveniently in desired combinations, and they of themselves form a convenient and accurate mode of administering important drugs.

Solution of Carmine.

℞ Carminis .... ʒ j.
Aquæ ammonia .... ℥ ss.
Aquæ .... ℥ iijss.

"Rub the carmine to a fine powder in a mortar, and dissolve by triturating with the aquæ ammonia; then add the water, and keep in a tightly corked bottle."

About one half drachm of this solution will color a pint of elixir or other preparations to the desired shade. The solution is incompatible with acids.

Solution of Carbolic Acid.

℞ Acidi carbolici (cryst.) .... ʒ x.
Glycerini .... ℥ ij.
Aquæ .... q. s., ad. O j.

Each fluidrachm contains grs. v of carbolic acid.

Solution of Pyrophosphate of Iron.

℞ Ferri pyrophosph. } .... āā ℥ iv.
Sacchari albi }
Aquæ fervens .... ℥ x.
Aquæ ammonia .... ʒ ss.

"Rub the iron and sugar to a fine powder in a mortar, and add the powder in small portions to the hot water, dissolving each portion added before adding another portion; continue the heat, if necessary, until dissolved, then add the aqua ammonia and make up the measure with warm water to a pint."

h four minims contain gr. j of the salt.

Hall's Solution of Strychnia.

℞ Strychnina (cryst.)................ grs. xvj.
Acetic acid .... ℥ ss.
Spts. vini rectif. }
Aquæ } .... āā ℥ vij.
Elixir (simp.)...................... ℥ jss.

Each fluidounce contains gr. j of strychnine. Dose, ten to twenty drops.

Solution of Salicylic Acid.

℞ Acidi salicylat. }
Sodii bicarb. } ....āā ℥ j.
Glycerini......................... ℥ vj.
Aquæ.............................. ℥ ix.

Dissolve the bicarbonate of soda in the water, mix the acid with the glycerin, then mix all together. This makes a solution of salicylate of soda.

GLYCERITES.

The glycerites have, within a few years, come into use, and possess some advantages not claimed for any other class of preparations.

Glycerite of Carbolic Acid.

℞ Acidi carbolici..................... ℥ iij.
Glycerini......................... ℥ xij.

Dissolve the acid by heat and add the glycerine.

Glycerite of Carbolate of Iodine.

℞ Acidi carbolici .... ℥ j.
Iodi............................... ℥ j.
Alcoholis .... ℥ iv.
Aquæ }
Glycerini } ....āā ℥ v.

Dissolve the carbolic acid in the glycerine, and add the water; dissolve the iodine in the alcohol, then mix the solutions.

Glycerite of Iodine (Decolorized).

℞ Tinct. iodi......................... ℥ viij.
Sodii hyposulphis .... ℥ j.
Glycerini .... ℥ viij.

Dissolve the hyposulphite of soda in the glycerine, add the tincture of iodine, and allow it to stand twenty-four hours and filter.

LIST OF NEW PHARMACOPŒIAL PREPARATIONS.

Triturations.

An elegant class of preparations recently introduced into the U. S. Phar. (1880) consists of:

The medicinal substance............. 1 part by weight.
Powdered milk-sugar................ 9 parts by "

The substance must be thoroughly mixed and so finely divided as to appear uniform when tested by a microscope magnifying 200 diameters.

The following is a list of the triturations chiefly used:

Arsenious acid.
Atropine.
Calcium sulphide.
Calomel.
Codeine.
Corrosive sublimate.
Elaterin.
Ipecac.
Iron arsenite.
Iron reduced.
Mercury iodide, green (yellow).
Mercury iodide, red.
Mercury, metal.
Morphine sulphate.
Strychnine.
Zinc phosphide.

Oleates.

The demand for these preparations has been steadily increasing since their recent introduction, owing to the fact that many physicians have found them more readily absorbed and more reliable as regards medicinal effects than the ointments which they are partially superseding. The following list represents those most frequently employed, with the percentage of the medicinal substance incorporated with the oleic acid:

Aconitine,	2 per cent.	Quinine,	25 per cent.
Atropine,	2 "	Plumbi oxidum,	20 "
Mercury,	10 "	Veratrine,	2 "
Morphine,	5 "	Zinci oxidum,	10 "

Abstracts.

For convenience of dispensing, the new pharmacopœial *powdered* extracts are very valuable.

Abstracts are all of one strength, viz.: one grain of the abstract represents two grains of the drug. They can usually be administered in doses of:

(*a*) One half the dose of the powdered drug.

(*b*) One half as many grains as the dose in minims of the fluid extract.

These preparations have many obvious practical advantages pharmaceutically, for they are uniform, permanent, and easily dispensed, and do not become wasted as compared with the solid extracts. Therapeutically, their value depends to a very great extent upon their relative fineness. Of all solid forms in which drugs are presented, these saccharated powdered extracts are thought to be the most efficient and desirable. Abstracts are now made of the following drugs:

Aconite (root).	Jalap (powder).
Belladonna (root).	Nux vomica (pewder).
Conium (fruit).	Opium (powder).
Digitalis (leaves).	Podophyllum (powder).
Hyoscyamus (leaves).	Senega (powder).
Ignatia (powder).	Valerian (powder).

MISCELLANEOUS FORMULÆ.

Brown Mixture.

℞ Pulv. ext. glycyrrhizæ } .... āā ℥j.
" acaciæ .... }
Spts. ætheris nitrosi................. ℥ss.
Vini antimonii...................... ℥j.
Tr. opii.. .... ʒ ijss.
Aquæ tepid....................... ℥xvj.

"Dissolve the gum acacia and extract of liquorice in the *warm* water; when cooled, add the other ingredients." This is similar, but not identical, with the compound mixture of liquorice of the U. S. P. Dose, ʒ i–iv.

Chlorodyne.

℞ Chloroformi }
Fl. ext. cannabis Indica } .... āā ℥j
Spts. ætheris comp. }
Tr. opii deod. } .... āā ℥jss.
Hydrocyanic acid, dil (U. S. P.)..... ʒ iij.
Ol. capsici........................ gtt. iij.

Dissolve the oil in the chloroform, add the comp. spirits of ether, and mix. Dose, ♏ v–xx. Use with caution.

Neutral Mixture.

℞ Potassii citratis.................... ℥jss.
Sacchari albi...................... ℥j.
Ol. limonis........................ gtt. viij.
Aquæ.............................. O j.

Dissolve the citrate of potash in the water, rub the oil of lemon thoroughly with the sugar, then dissolve the sugar in the mixture, and filter.

Dose: Tablespoonful every two hours as a diuretic. As a diaphoretic it may be used either alone or with the addition of antimonial wine, of spirit of nitrous ether, of morphine, or of all united.

Camphor Chloral.

℞ Gum camphoræ }
Chloralhydratis } .... āā ℥ ij.

Rub the camphor to a fine powder by the addition of a few drops of alcohol, and add the hydrate of chloral, rubbing together until dissolved. This makes a liquid about the consistency of glycerine, and is used topically in neuralgia, toothache, etc. Its anodyne effects may be increased by the addition of morphine, aconite, atropine, or chloroform. Camphor chloral is best given internally dropped on a lump of sugar.

Dewees's Emmenagogue Mixture.

℞ Tinct. ferri chloridi................. f ʒ iij.
Tinct. cantharidis.................. f ʒ j.
Tinct. aloes......................... f ℥ ss.
Tinct. guaiaci ammoniatæ........... f ℥ jss.
Syrupi.................... q. s., ad. f ℥ vj.
M. S. Tablespoonful three times a day.

The above formula may be relied upon almost exclusively in the treatment of simple atonic *amenorrhœa.* The proportion of the various ingredients should be varied to suit individual cases. Thus, the amount of iron should be altered according to the extent of the anæmia, the aloes according to the state of the bowels, and the cantharides according to the susceptibility of the urinary organs.

Chapman's Copaiba Mixture.

℞ Copaibæ }
Spirit. ætheris nitrosi } .... āā f ℥ ss.
Acaciæ pulv. }
Sacch. albi } .... āā ʒ j.
Tinct. lavand. co..................... f ʒ ij.
Tinct. opii .... f ʒ j.
Aquæ destil .... f ℥ iv.
M. S. Tablespoonful three times a day.

Durkee's Gonorrhœal Mixture.

℞ Copaibæ.......................... f ℥ iij.
Spiritus ætheris nitrosi }
Tinct. kino } ....āā f ℥ ss.
Morphinæ sulphatis................. grs. iv.
Aqua camphoræ.................... f ℥ ij.
M. S. One teaspoonful thrice daily.

Usually an efficient check will be put to the gonorrhœa in eight or ten days by the use of this combination:

℞ Copaibæ .... f ℥ j.
Olei cubebæ........................ f ʒ j.
Liquoris potassii.................... f ʒ vj.
Spiritus myristicæ.................. f ʒ j.
Aqua camphoræ.................... f ℥ ij.
M. S. Dessertspoonful thrice daily.

This combination of copaiba with the oil of cubebs will sometimes be found to agree better with the stomach than most other preparations, while it diminishes the acidity of the urine. The use of copaiba and cubebs should only be employed in the subacute stage of the disease. In the active stag

to render the urine alkaline, to diminish frequent micturition, and to relieve chordee, the following may be employed:

℞ Potassii nitratis.................... ʒ ij.
Potassii bromidi.................... ʒ iv.
Morphinæ sulphatis.................... grs. ij.
Ext. gelsemii fld.................... ʒ j.
Syrupi.................... ℥ j.
Aqua camphoræ.......... q. s., ad. ℥ vj.

M. S. Tablespoonful in half a glass of water two hours after meals.

Gonorrhœal Injection.

℞ Morphinæ sulphatis.................... grs. iv.
Ext. belladonnæ alc.................... grs. v.
Mucilaginis cydonii }
Aquæ............ } .... āā ℥ ij.

M. S. Add a teaspoonful to a tablespoonful of hot water, and use every four hours in the acute stage of the disease.

As soon as the acute stage subsides, use astringent injections as follows:

℞ Zinci sulphatis.................... ℈ j.
Morphinæ sulphatis.................... grs. iv.
Glycerini.................... ℥ ss.
Aquæ....................ad. ℥ iv.

M. S. Use ʒ i four times a day.

In the latter stages of gonorrhœa, when the discharge is profuse and watery, and when there appears to be a loss of tone or relaxed condition of the mucous membrane, the following injection should be used:

℞ Zinci oxidi pulv.................... ʒ ij.
Ext. hydrastis fld.................... fʒ ij.
Mucilaginis cydonii.................... ℥ iij.
Aquæ....................ad. ℥ iv.

M. S. Use three times a day.

In gleet, the following mixture should be taken inwardly:

℞ Tinct. cantharidis }
Olei terebinth. } .... āā f℥ ss.
Mucilaginis acaciæ.................... f℥ iij.

M. S. A teaspoonful thrice daily.

Bumstead's Gonorrhœal Mixture.

℞ Copaibæ.................... f℥ j.
Liquor potassii.................... fʒ ij.
Ext. glycyrrhizæ.................... ℥ ss.
Spts. ætheris nitrosi.................... ℥ j.
Syrup. acaciæ.................... f℥ vj.
Ol. gaultheriæ.................... gtt. xvj.

Mix the copaiba and the liquor potassæ, and the extract of liquorice and spirits of niter first separately, and then add the other ingredients.

Dose: A tablespoonful after each meal.

Menorrhagia.

℞ Ext. ergot fld. }
Tinct. digitalis } .... āā ʒ ij.
Tinct. cannabis Indicæ............. ℥ ss.

M. S. Teaspoonful three times a day. S.

Chronic Bronchorrhœa.

℞ Ext. eucalypti fld.................... ℥ j.
Ammonii chloridi.................... ʒ ij.
Ext. glycyrrhizæ.................... ʒ ij.
Syrup. tolu.................... ℥ iij.

M. S. Teaspoonful every two or three hours. BIDDLE.

Antimonial Saline Mixture.

℞ Antimon. et pot. tartratis............ grs. xij.
Magnesiæ sulphatis.................. ℥ jss.
Morphinæ sulphatis................. grs. iij.
Tr. aconiti radicis.................. gtt. xxiv.
Aquæ.............................. ℥ xij.

M. S. Tablespoonful every four hours in general systemic inflammation.
GROSS.

Infantile Colic.

℞ Sodii bicarb. / Chloralhydrat. / Potassii bromidi .... āā grs. viij.
Syrupi / Aquæ .... āā ʒ iv.

M. S. Teaspoonful every two hours until relieved.

Basham's Mixture.

℞ Tinct. ferri chloridi................ ℥ j.
Acidi acetici....................... ʒ ij.
Liquor. Ammonii acetatis........... ℥ iv.
Syrupi simp........................ ʒ vi.

M. S. Teaspoonful three or four times a day.

Mixture of the Four Chlorides.

℞ Hydrarg. chloridi corrosivi.......... grs. j–ij.
Liq. arsenici chloridi............... ʒ j.
Tr. ferri chloridi / Acid hydrochlorici, dil. .... āā ʒ iv.
Syrupi............................. ℥ iij.
Aquæ.................... q. s., ad. ℥ vi.

M. S. One dessertspoonful in a wine-glass of water after each meal.

Anæmic and chlorotic patients will fatten and thrive wonderfully on the above mixture; but it should not be given for a longer period than two weeks at a time.
GOODELL.

Mistura Strychnina Comp.

℞ Strychninæ sulphatis................ gr. j.
Ferri pyrophosphatis / Sodii phosphatis / Quininæ sulphatis .... āā ʒ j.
Acidi phosphor. diluti / Syrupi zingiberis .... aa f℥ ij.

M. S. Teaspoonful three times a day in a little water.

This extemporaneous mixture for *neurasthenia* is preferable to any of the manufactured elixirs or syrups with like ingredients.
HAMMOND.

Fleming's Solution.

℞ Plumbi acetatis...................... grs. xxiv.
Morphinæ acetatis.................. gr. ij.
Acidi acetici dil..................... ♏ xij.
Aquæ destil......................... f℥ vi.

M. S. Tablespoonful every two hours with an equal quantity of water.

The above is a most useful combination in passive diarrhœa, and is most efficient when taken on an empty stomach. In the diarrhœa of children the same mixture, according to the following formula, gives most valuable results:

℞ Plumbi acetatis..................... grs. xij.
Tr. opii acetata..................... ♏ xij.
Acidi acetici, dil.................... fʒ ss.
Aquæ destil......................... f℥ iij.

M. S. Teaspoonful every five, six, or eight hours to a child one year of

Squibb's Cholera Mixture.

℞ Tr. opii deod.
Spirit. camphoræ } .... āā f℥j.
Tr. capsici
Chloroformi .... fʒiij.
Spts. vin. rectif. (95 per cent). ad. q. s. f℥v.

Each fluidrachm or teaspoonful contains about 100 drops, consisting of 12 minims each of the first three ingredients and 4½ minims or 18 drops of chloroform.

Dose: For adults, one teaspoonful in water after each evacuation.

Oleaginous Mixture.

℞ Olei ricini........................... fʒij.
Acaciæ pulveris..................... ʒj.
Tr. opii............................. ♏viij.
Syrupi.............................. fʒij.
Aquæ cinnamomi. ....q. s., ad. f℥ij.
M. S. Teaspoonful for a child six years old.

A very efficient mixture in dysenteric diarrhœa.

Dawson's Solution.

℞ Magnesii sulphatis .... f℥j.
Acidi sulphurici dil................ fʒij.
Aquæ................................ f℥iv.
M. S. Tablespoonful every three or four hours.

May be used with advantage in dysentery; and gr. j of morphine may be added to the mixture if indicated.

Mistura Ferri Laxans.

℞ Ferri sulphatis..................... grs. xxxij.
Magnesii sulphatis.................. ℥ij.
Acid sulphurici dil................. fʒj.
Spts. chloroformi................... fʒv.
Aquæ menth. pip.................... Oj.
M. S. One to two tablespoonfuls three times a day.

SQUIRE.

Tasteless Quinine.

℞ Quininæ sulphatis.................. grs. x.
Ext. glycyrrhiz. pulv. .... grs. xv.
Sacch. lactis........................ grs. xx.
M. Ft. charts No. X, more or less to suit the age, and give in water.

℞ Quininæ sulphatis. .... grs. viij.
Elixir glycyrrhizæ.................. ℥j.
M. S. Teaspoonful as required. A very suitable form of administration to children.

EMULSIONS.

Many medicinal agents require administration in the form of emulsions. In their preparation the water and powdered gum acacia should be mixed first, always using half the amount of acacia that we do of water. If using an oil, mix the acacia and oil first, adding the water a moment after the oil. If turpentine or copaiba is used, cut it with half the amount of alcohol, and add to this the gum and water, syrup, etc.

GELATINE-COATED PILLS AND GRANULES.

Messrs. McKesson & Robbins, of New York, and other pharmaceutical chemists of this country, have of late years given much attention to the manufacture of gelatine-coated pills and granules, which can be procured from druggists in all parts of the United States. In the following list will be ınd most of the important pills of the U. S. Pharmacopœia, besides many nulæ furnished by distinguished practitioners, and some of the newer

chemical preparations which, we are assured, are accurately compounded of the best materials, and hence may be prescribed with confidence by the practitioner:

Pills of Aloes and Myrrh, U. S. P.

Aloes soc. pulv......................	grs. 2
Myrrhæ pulv	gr. 1
Pulv. aromatici.	gr. ½

A warm stimulant cathartic in general debility attended with constipation and retention, or suppression of the menses. The formula is the same as that of *Rufus's pills.* Dose: Three to six pills.

Anti-Periodic.

Chinoidini...........................	gr. 1
Ferri ferrocyanidi.....................	gr. 1
Ol. piper. nig.........................	gr. 1
Acid. arseniosi	gr. 1/20

Dose: One or two pills after meals.

Anti-Dyspeptic.

Strychninæ.	gr. 1/40
Ext. belladonnæ	gr. 1/10
Ipecacuanhæ pulv	gr. 1/10
Pil. hydrarg.	grs. 2
Ext. colocy. co., pulv................	grs. 2

Dose: One to two pills.

Aloes, Nucis Vomicæ et Belladonnæ.

Pulv. aloes socot.	gr. 1½
Ext. nucis vomicæ....................	gr. ½
Ext. belladonnæ fol..................	gr. ⅛

Dose: One or two pills.

Aloin, Strychninæ et Belladonnæ.

Aloin..................................	gr. 1/5
Strychninæ	gr. 1/60
Ext. belladonnæ......................	gr. ⅛

Dose: One pill at bed-time, and also by 10 A. M. the following day, if required in chronic constipation.

Aperient (Dr. Fordyce Barker's).

Ext. coloc. comp.	gr. 1⅜
Ext. hyoscyami.......................	gr. 1¼
Pulv. aloes socot......................	gr. 5/12
Ext. nucis. vomicæ	gr. ½
Pulv. ipecac..........................	gr. 1/12
Resinæ podophylli	gr. 1/12

Dose: One or two pills.

Cathartic Comp., U. S. P.

Ext. coloc. comp.	gr. 1⅓
Ext. jalapæ pulv......................	gr. 1
Hydrarg. chlor. mit.	gr. 1
Pulv. gambogiæ.......................	gr. ¼

Dose: One to three pills.

Cathartic Comp. (Improved).

Ext. colocynth comp.................	gr. 1⅓
Ext. jalapæ...........................	gr. ⅛
Res. podophylli......................	gr. ⅛
Res. leptandræ.......................	gr. ⅜
Ext. hyoscyami......................	gr. ¼
Ext. gentianæ........................	gr. ½
Ol. menth. pip.......................	gtt. 1/40

Dose: One to three pills.

Cathartic Comp. (*Vegetable*).

Ext. colocynth	gr. 1/6
Res. podophylli	gr. 1/4
Pulv. res. scammon	gr. 1/8
Pulv. aloes socotrin	gr. 1 1/4
Pulv. cardamomi	gr. 1/9
Pulv. saponis	gr. 1/6

Dose: One to three pills.

Anti-Bilious (*Cook's*).

Pulv. aloes soc.	gr. 1
Pulv. rhei	gr. 1
Hydrarg. chlor. mit.	gr. 3/4
Pulv. saponis	gr. 1/4

Dose: One to three pills.

Copaibæ Comp. (*H. H. Smith's*).

Pulv. cubebæ	grs. 2
Pil. copaibæ	gr. 1
Ferri sulph. exsic.	gr. 1/2
Terebinth. venet.	gr. 1/2

Dose: two to five pills after meals. These pills are very efficient in chronic gonorrhœa.

Emmenagogue Pills.

Ergotin	gr. 1
Ext. hellebori	gr. 1
Pulv. aloes soc.	gr. 1
Ferri sulph. exsic.	gr. 1
Ol. sabinæ	♏ 1/4

Dose: One to three pills.

Emmenagogue Pills (*Improved*).

℞ Ferri redactum	gr. 1
Ext. aloes socot.	gr. 3/8
Pulv. ipecac.	gr. 1/2
Ext. nucis vomicæ	gr. 1/8
Ol. sabinæ	gr. 1/4

Dose: One pill three times daily after each regular meal.
Of great value in chlorosis and amenorrhœa.

Ergotin Comp. (*Dr. Clement Godson*).

Ergotin	grs. 3
Ext. cannab. Indicæ	gr. 1/16
Strychninæ	gr. 1/60

Dose: One or two pills.

This pill was recommended to us by Dr. Godson, of London, who uses it largely in his extensive obstetrical practice; he speaks very highly of its great value, saying that the strychnine increases the activity of the ergotin, while the Indian hemp tends to alleviate pain.

Ferruginous (*Blaud's*).

Ferri sulph.	grs. 2 1/2
Potass. carb	grs. 2 1/2

Dose: One to three pills.

These pills are admirably adapted for the assimilation of iron, as the ingredients react upon each other to form protoxide of iron, which, owing to the protection afforded by the soluble coating, remains unaltered until freed for action by the stomach juices.

Hepatic Pills.

Pil. hydrarg.	grs. 3
Ext. coloc. comp.	grs. 2
Ext. belladonnæ	gr. 1/4

Dose: One or two pills.

A good pill where special action on the liver is desired united with a mild purgative. The presence of the belladonna allays the irritant action of the colocynth.

Heim's Anti-pyretic Pills (Niemeyer).

Quininæ sulph	gr. 1
Pulv. digitalis	gr. 1/2
Pulv. ipecac..........................	gr. 1/4
Pulv. opii............................	gr. 1/4

Dose: One pill three times a day.

Neuralgic (Dr. Gross's).

Quininæ sulph	grs. 2
Morphinæ sulph	gr. 1/20
Strychninæ..........................	gr. 1/30
Acidi arseniosi......................	gr. 1/20
Ext. aconiti.........................	gr. 1/16

Dose: One pill two or three times a day after meals.

Neuralgic (Brown-Séquard's).

Ext. hyoscyami.....................	gr. 3/8
Ext. conii	gr. 3/8
Ext. ignat. amaræ..................	gr. 1/2
Ext. opii............................	gr. 1/3
Ext. aconiti, foi	gr. 1/6
Ext. cannab. Ind	gr. 1/4
Ext. stramonii......................	gr. 1/5
Ext. belladonnæ, fol................	gr. 1/6

Dose: One pill every six hours until relieved.

Opii, Pulv .... gr. 1/8, gr. 1/4, gr. 1/2

Dose: 1/8 to 1 grain.

Opii, U. S. P. .... gr. 1

Dose: One grain. The *old pills* of opium which have become hard, and which dissolve slowly, are of especial advantage in inflammatory affections of the bowels.

Opii et Camphoræ.

Pulv. opii	gr. 1
Camphoræ..........................	grs. 2

Dose: One pill every three or four hours in diarrhœa.

Opii, Camphoræ et Acidi Tannici.

Pulv. opii..........................	gr. 1/4
Camphoræ.........................	gr. 1
Acid tannici	grs. 2

Dose: One or two pills. Very useful in passive diarrhœa.

Phosphorus, Nux Vomica, and Cantharides.

Phosphorus........................	gr. 1/60
Pulv. nucis vomicæ	gr. 1
Tinct. canthar. conc................	♏ 1

Dose: One or two pills two or three times a day with food.

Recommended as a gentle stimulant to the genito-urinary organs, a useful remedy in incontinence and retention of urine, and in premature loss of sexual power. Also successfully prescribed in some cases of amenorrhœa and leucorrhœa.

Pilocarpinæ Hydrochloratis .... gr. 1/8

Dose: 1/8 to 3/4 grain.

The hydrochlorate (muriate) is the most eligible of the salts of the alkaloid of jaborandi.

Podophyllin, Capsicum, and Belladonna.

Podophyllin........................ gr. 1/4
Ext. bellad. alc...................... gr. 1/8
Pulv. capsici........................ gr. 1/2

Dose: One pill every night, or every other night, just before going to bed, will often correct a habit of constipation.

Podophylli Comp. (Dr. Janeway's).

Resinæ podoph...................... gr. 1/2
Pulv. aloes socot.................... gr. 1
Ext. belladon., fol.................. gr. 1/4
Ext. nuc. vom...................... gr. 1/4

Dose: One pill, at bed-time.

Podophyllin et Hydrarg.

Resin podophylli.................... gr. 1/2
Pil. hydrarg........................ grs. 2 1/2

Dose: One pill. An excellent cholagogue.

Quininæ Bisulphatis........gr. 1/4, gr. 1/2, gr. 1, grs. 2, grs. 3, grs. 4, grs. 5.

Dose: One to twenty grains.

"Quinine bisulphate contains a little over 59 per cent of the pure alkaloid. It is soluble in about 10 parts of water, being the most soluble of the several quinine salts now used in medicine. Its ready solubility would probably make it more promptly active than the quinine sulphate. It requires, however, 25 per cent more of the bisulphate than of the sulphate to represent the same amount of alkaloid."

Quininæ et Strychninæ. Comp.

Quininæ sulph...................... gr. 1
Ferri redact........ .... gr. 1
Strychninæ........................ gr. 1/20
Acidi arseniosi...................... gr. 1/20

Dose: One pill three times daily after meals.

Syphilitic (Ricord's Modified).

Hydrarg. iodidi viridis.............. gr. 1/2
Lactucarii.......................... gr. 1/2
Ext. opii.......................... gr. 1/10
Ext. conii.......................... gr. 1 1/2

Dose: One pill at bed-time.

Should NOT be given in connection with iodide of potassium.

Triplex (Dr. Francis's).

Resinæ scammonii.................. gr. 1 1/5
Pulv. aloes soc...................... gr. 1 1/5
Pil. hydrarg........................ gr. 1 1/5
Ol. tiglii.......................... ♏ 1/20
Ol carui.......................... ♏ 1/4
Tinct. aloes et myrrh., q. s.

Dose: One or two pills.

Zinci Phosphidi et Nucis Vomicæ.

Zinci phosphidi..................... gr. 1/10
Ext. nucis vomicæ.................. gr. 1/4

Dose: One to three pills.

Tonic. Useful in palsy, neuralgia, and chronic constipation; also in brain diseases.

SOLUBLE GRANULES.

Morphinæ Acetatis.................................. gr. $^1/_{16}$, gr. $^1/_8$, gr. $^1/_4$
Dose: $^1/_{16}$ to $^1/_8$ grain.

Morphinæ Hydrochloratis............................ gr. $^1/_8$, gr. $^1/_6$, gr. $^1/_4$
Dose: $^1/_{16}$ to $^1/_4$ grain.

Morphinæ Sulphatis.... gr. $^1/_{32}$, gr. $^1/_{20}$, gr. $^1/_{16}$, gr. $^1/_{10}$, gr. $^1/_8$, gr. $^1/_6$, gr. $^1/_4$
Dose: $^1/_{16}$ to $^1/_8$ grain.

Morphinæ Valerianatis.. gr. $^1/_8$
Dose: $^1/_8$ to $^1/_4$ grain.

Morphinæ et Atropinæ.

Morphinæ sulph..................... gr. $^1/_{24}$
Atropinæ sulph..................... gr. $^1/_{300}$
Dose: One or two pills.

Morphinæ et Atropinæ.

Morphinæ sulph..................... gr. $^1/_8$
Atropinæ sulph..................... gr. $^1/_{100}$
Dose: One pill.

Hydrargyri Iodidi Viridis.................. .... gr. $^1/_6$, gr. $^1/_4$, gr. $^1/_2$
Chiefly used in scrofula and scrofulous syphilis. Should never be given at the same time with iodide of potassium, which converts it into bin-iodide.

The dose recommended in the U. S. Disp. is 1 gr. gradually increased to 3 or 4 grs., while in the National Disp. the dose given is from $^3/_4$ to 1 gr.; even the latter dose was criticised in the "Medical Record," 1879, and both Dr. Piffard and the late Professor Bumstead agree that one-half grain should never be exceeded.

PARVULES.

Small Doses for Frequent Administration.

This is a new class of medicines (minute pills) designed for administration of remedies in small doses for frequent repetition in cases of children and adults. It is claimed by some practitioners that small doses given at short intervals exert a more salutary effect.

The dose of any of the parvules will vary from one to four, according to age, or the frequency of their administration. For instance, one parvule every hour, or two every two hours, or three every three hours, and so on for adults. For children, one three times a day is the minimum dose.

The following list, prepared by W. R. Warner & Co., Philadelphia, represents the most important preparations of this class:

Aloin, parv.. gr. $^1/_{10}$
Medical property: A most desirable cathartic.

Dose: Four to six at once. This number of parvules, taken at any time, will be found to exert an easy, prompt, and ample cathartic effect, unattended with nausea, and in all respects furnishing the most desirable aperient and cathartic preparation in use. For habitual constipation it replaces, when taken in single parvules, the various medicated waters, without the quantity which they require as a dose, which fills the stomach and deranges the digestive organs.

Calomel, parv.. gr. $^1/_{20}$
Med. prop.: Alterative, purgative.

Dose: One to two every hour. Two parvules of calomel, taken every hour, until five or six doses are administered (which will comprise but half a grain), produce an activity of the liver, which will be followed by bilic

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dejections and beneficial effects, that twenty grains of blue mass or ten grains of calomel rarely cause, and sickness of the stomach does not usually follow.

Podophyllini, parv .... gr. 1/40
Med. prop.: Cathartic, cholagogue.

Two parvules of podophyllin, administered three times a day, will re-establish and regulate the peristaltic action and relieve habitual constipation, add tone to the liver, and invigorate the digestive functions.

Acidi arseniosi .... gr. 1/100
Med. prop.: Alterative, antiperiodic.

Acidi salicylici .... gr. 1/10
Med. prop.: Antirheumatic.

Acidi tannici .... gr. 1/20
Med. prop.: Astringent.

Aconiti rad .... gr. 1/20
Med. prop.: Narcotic, sudorific.

Aluminis .... gr. 1/10
Med. prop.: Astringent.

Antimonii et potass. tart. ..... gr. 1/100
Med. prop.: Expectorant, alterative.

Arsenici iodidi .... gr. 1/100
Med. prop.: Alterative.

Belladonnæ fol .... gr. 1/20
Med. prop.: Narcotic, diaphoretic, diuretic.

Camphoræ .... gr. 1/20
Med. prop.: Diaphoretic, carminative.

Cantharidis .... gr. 1/50
Med. prop.: Diuretic, stimulant.

Capsici .... gr. 1/20
Med. prop.: Stimulant, carminative.

Cathart. comp., U. S. P. ...... gr. 1/3
Med. prop.: Cathartic.

Cathartic comp. imp .... gr. 1/3
Med. prop.: Cathartic.

Digitalis fol .... gr. 1/20
Med. prop.: Sedative, narcotic, diuretic.

Dover's powder .... gr. 1/3
Med. prop.: Anodyne, soporific.

Ergotinæ .... gr. 1/10
Med. prop.: Emmenagogue, parturient.

Ferri redacti .... gr. 1/10
Med. prop.: Tonic.

Gelsemii rad .... gr. 1/60
Med. prop.: Nervous and arterial sedative.

Hydrarg. bi-chlor .... gr. 1/100
Med. prop.: Mercurial, alterative.

Hydrarg. cum creta .... gr. 1/10
Med. prop.: Alterative.

Hydrarg. iodidi .... gr. 1/20
Med. prop.: Alterative.

Hydrastin .... gr. 1/20
Med. prop.: Tonic, astringent.

Iodoformi .... gr. 1/10
Med. prop.: Alterative.

Ipecac .... gr. 1/50
Med. prop.: Emetic, expectorant.

Morphinæ sulph .... gr. 1/50
Med. prop.: Narcotic, sedative.

Nucis vomicæ .... gr. 1/50
Med. prop.: Tonic, stimulant.

Opii .... gr. 1/40
Med. prop.: Narcotic, sedative, anodyne.

Phosphorus .... gr. 1/200
Med. prop.: Nerve stimulant.

Piperinæ .... gr. 1/20
Med. prop.: Tonic, antiperiodic, carminative.

Potassii arsenitis .... gr. 1/100
Med. prop.: Alterative.

Santonini .... gr. 1/10
Med. prop.: Anthelmintic.

Strychninæ .... gr. 1/100
Med. prop.: Nerve stimulant, tonic.

Poisons and their Antidotes.

When symptoms of severe disorder make their appearance *suddenly* in a healthy person, and soon after some substance has been swallowed, he may be suspected of being poisoned.

In such cases, and before the required antidote can be obtained, the poison should be, as far as possible, dislodged by inducing free emesis; and demulcent drinks, which may envelop the poison and prevent for the time its specific action, should be exhibited freely.

Emetics.—For this purpose a tablespoonful of common table-salt and ground mustard stirred in a pint of water may be given, or such other direct emetics as sulphate of zinc with pulv. ipecac (10 grains, added to 20–30 grains), or the sulphate of copper, 2–5 grains, or a hypodermic injection of hydrochlorate of apomorphine ($^1/_{10}$ grain) may be employed.

The *stomach-pump*, or *tube*, may be used on the siphon principle when vomiting can not be induced by emetics, except in the cases of irritant poisoning where its use requires great caution. After the accomplishment of the above, gentle cathartics and diuretics may be given to aid in the elimination; also iodide of potassium if the poisoning is due to metallic substances.

Counteract the morbid vital processes induced by the poison—as in cardiac syncope, give stimulants; in threatened paralysis of the respiratory movements, excite respiration by cold effusions, irritation of the skin, artificial respiration, atropine to excite the pneumo-gastric nerve; in narcosis of the brain, endeavor to arouse it. Allay any particular organic irritation.

Antidotal measures are: (1) chemical, which directly neutralize the action of the poison by destroying its properties; (2) physiological, which have antagonistic properties to the poison.

General antidote where nature of the poison is unknown: ℞ Ferri sulphatis, ʒj; aquæ, Oj; carbo ligni pulveris, magnesiæ, āā ℥ij. M. S. To be well agitated and given in doses of a wineglassful, *pro re nata.*

It is recommended to medical men residing in the country that a stomach-pump and several of the antidotes mentioned below should be kept in an exposed position, to which access can at all hours be had, and also that the phials containing the antidote be labeled with its name, and that of the poison for which it is to be administered.

Cases of secret poisoning are undoubtedly more frequent than is generally supposed, and are often mistaken for disease by physicians.

A physician, on being called to a case of supposed poisoning, should make a minute and accurate note of all the symptoms, as they alone form the commencement of medico-legal inquiry; he should examine every article of a suspicious nature, such as phials, boxes, or papers containing powders, and should see that they are carefully preserved. If the patient be rational, all possible information should be obtained from him; and, if practicable, any portion of the poisonous substance that may remain should be secured.

All vomited or other matters which may contain traces of, or afford a clew to the poison, must be reserved for a careful inspection. Sometimes individuals, from throwing away, in the excitement of the moment, the ejecta, have found themselves unpleasantly situated, and objects of suspicion.

Should the symptoms resemble those of poisoning by copper or tin, the kitchen utensils should be carefully examined, as from this simple precaution much anxiety may be relieved.

POISONS.	SYMPTOMS.	ANTIDOTES.
Acid, hydrocyanic or prussic. Laurel water. Cyanide of potassium.	In large doses, immediate death; in smaller: Extreme nervous prostration and paralysis, gradually terminating in death. Odor of the poison is very perceptible on breath, and from all secretions.	Sulphuric ether exhibited in drachm doses and repeated every few minutes until symptoms subside. Atropinæ sulph., gr. $^1/_{20}$ hypodermically. Inhalation of steam containing liq. ammoniæ, cold douche, friction to the spine. Bleeding from jugular vein. Artificial respiration. *Chlorine water* in strength two drachms to one ounce, or a weak solution of sulphate of iron.
Acid, Hydrochloric. *Acid*, nitric.	In large doses, immediate death; a peculiar shriveled appearance of mucous membrane of mouth and throat; intense	Repeated and copious draughts of *water* to dilute the acid. *Chalk or calcined magnesia* in milk Strong solution of soap. Soluti of soda is by many preferred.

POISONS AND THEIR ANTIDOTES.—(*Continued.*)

POISONS.	SYMPTOMS.	ANTIDOTES.
Acid, sulphuric.	burning in throat, œsophagus, and stomach; matter vomited exhibits acid reactions. Hydrochloric and sulphuric acid stain the mouth and lips *black* and nitric acid produces a *yellow* stain.	It should be recollected that the mineral acids are very rapid in their escharotic action upon the animal tissues, and that, even if antidotes are instantly and successfully employed, a certain mischief is always inflicted; therefore, in after-treatment, avoid distending the stomach with liquids, and be careful in the use of the stomach-pump.
Acid, oxalic.	Intense burning pain of mouth and throat and stomach, vomiting blood which is highly acid, violent purging, collapse, stupor, death. *Note.* Frequently taken in mistake for Epsom salts, to which in shops it often bears a strong resemblance.	From the rapidity and certainty with which it destroys life, no time is to be lost in attempting its expulsion by emetics, etc. Employ immediately *chalk* or carbonate of magnesia in substance or solution. Avoid all alkaline carbonates. After-treatment, mucilaginous drinks, lime-water, and oil. Warmth and stimulants.
Alkalies. Ammonia. Caustic potash.	Excoriation of mouth and fauces, burning in throat, chest, stomach, and intestines; colic, purging and vomiting of bloody matter.	Vinegar, lemon juice, and citric acid, with large quantities of water. Fixed oils. Mucilaginous and demulcent drinks. Stomach-pump should not be used.
Animal. Conger. Mussels. Crabs. Craw-fish.	Those of sporadic cholera followed by paralysis of lower extremities. Nausea, immoderate thirst, irritating eruption of skin, low pulse, subsultus, coldness of extremities, rarely death.	Evacuate as rapidly as possible the contents of the stomach and bowels. Acidulous drinks; chloroform internally in drachm doses. Pure Cayenne pepper is thought to be a specific.
Animal. Bites of serpents. Rattle-snakes. Copper-heads. Vipers.	Great pain in the bitten part, increased on pressure, swelling at first pale, then red, livid, gangrenous, and excessively hard. Vomiting, convulsions, small pulse, increased respiration, cold sweats, delirium, death.	Apply a ligature above the wounded part, use the actual cautery, or any active caustic. Apply cupping-glass or suction by the mouth. Brandy and whisky in large quantities, with other active stimulants. *Bibron's Antidote.* ℞ Potassii iodidi............. gr. iv. Hydrarg. chlorid. corros ... gr. ij. Bromi.................... f℥ v. Dose: Five drops in a tablespoonful of wine or brandy; repeated as often as necessary. And apply topically. To be kept in a well-stopped phial. Bisulphite of soda in large doses has been highly recommended. Arsenic has also been found to possess extraordinary power in arresting the poison.
Antimony, chloride of.	Difficulty in swallowing, vomiting, pain in throat, dilated pupils, stupor, violent griping tenesmus, collapse, stupor, death.	As an emetic, copious emollient and demulcent drinks, containing excess of sugar, followed by antidotes for other preparations of antimony.

POISONS AND THEIR ANTIDOTES.—(*Continued.*)

POISONS.	SYMPTOMS.	ANTIDOTES.
Arsenic and its preparations.	May appear in a few minutes or not for several hours. Faintness, nausea, intense burning pain in stomach and throat, vomiting of a turbid brown fluid, intense thirst, purging, cold sweats, convulsions, death.	*Hydrated oxide of iron*, recently prepared and in large doses, procured by the addition of an excess of aqua ammoniæ to tinct. ferri chloridi, or, better, liq. ferri tersulph., which yields the oxide as a dense precipitate, and should be given in tablespoonful doses every five minutes until the symptoms are relieved. While the above is in preparation, emetics should be freely exhibited and the stomach emptied and carefully washed with the pump.
Belladonna. *Stramonium and Hyoscyamus.* *Tobacco.*	Dryness of mouth and throat, great thirst, difficult deglutition, nausea, loss of vision, vertigo, delirium, coma, death. Vertigo, headache, perversion of vision, slight delirium, sense of suffocation, disposition to sleep, bowels relaxed and all secretions augmented. Vertigo, stupor, fainting, nausea, vomiting, sudden nervous debility, cold sweat, tremors, and at times fatal prostration.	The most prompt emetics and use of the stomach-pump. Large draughts of tincture or infusion of cinchona or galls. Calabar-bean. Tannin in large doses. Electro-magnetism. Opium has been used with much success. Active stimulation. Cayenne pepper, ammonia, brandy, cold douche, and chloroform. Animal charcoal in large doses. *Note.* The antagonistic action of opium and belladonna must not be overlooked. Tobacco requires whisky, strychnine, or stimulating enema containing turpentine or ammonia.
Aconite.	Burning and numbness of the mouth, throat, and stomach, violent vomiting, but neither coma nor convulsions.	As above. Immediate and free administration of animal charcoal mixed with water, and followed by brisk emetic. Use tr. digitalis in full doses.
Copper, salts of. *Verdigris.*	Dryness of mouth and throat, nausea, ptyalism, coppery eructations, vomiting, severe colic, excessive thirst, diarrhœa, convulsions, insensibility, and collapse.	Large doses of simple syrups as warm as can be swallowed, until the stomach rejects the amount it contains. The whites of eggs and large quantities of milk. Hydrated oxide of iron.
Gases. Carbonic acid, chlorine, cyanogen, hydro-sulphuric acid, etc.	Great drowsiness, difficult respiration, features swollen, face blue as in strangulation.	Artificial respiration, cold douche, frictions with stimulating substances to the surface of the body. Inhalations of steam containing preparations of ammonia. Cupping from nape of neck. Internal use of chloroform or ether, and the application of electricity.
Lead and its soluble salts.	Inflammation of the throat, stomach, and intestines, paleness, constipation, drawing in of belly, loss of voice, dilated pupil, cold sweats, locked jaw, paralysis, violent convulsions, death.	Sulphates of soda and magnesia, which form sulphate of lead; free use of emetics—preferably alum or sulphate of zinc. Albumen and milk in large quantities. Chloroform internally, until symptoms are relieved.
Mercury, bichloride of.	Styptic, metallic, acid taste, constriction, and burning of throat, salivation, great anxiety, tear-	The whites of eggs well mixed with water, in large quantities, and continued until the vomit becomes transparent.

POISONS AND THEIR ANTIDOTES.—(*Continued.*)

POISONS.	SYMPTOMS.	ANTIDOTES.
(Corrosive sublimate.)	ing pains in stomach and intestines; vomiting of bilious and, after some time, bloody matter, diarrhœa, tenesmus, small, quick, hard pulse, faintings, cramps, convulsions, coma, death.	A mixture of soap and wheat-flour in water. Stomach-pump to be used with caution—may produce perforation.
Mushrooms.	Nausea, vomiting, purging, colic, cramps of lower extremities, excessive thirst, convulsions, coma, death, or aggravated cholera morbus.	Brisk emesis to be produced if the irritating substance has not been freely ejected. Chloroform internally, or morphine subcutaneously.
Agaric and vegetable acids.		Chalk or magnesia.
Nux Vomica. Strychnia.	Tetanic twitchings, rigidity of extremities, alternating with subsultus, difficult respiration; excruciating pain under xiphoid cartilage, asphyxia, and death.	Evacuate stomach by pump; give hydrate of chloral or chloroform internally in drachm doses, frequently repeated until symptoms are relieved. Tannin in excess 20 or 25 times that of the poison taken. Animal charcoal in large doses.
Opium and its preparations.	Giddiness, stupor not always preceded by excitement, slow breathing, closed eyes, pupils contracted, features ghastly, pulse feeble and imperceptible, delirium, cold sweat, relaxed muscles.	Instant removal of poison by active emetics and stomach-pump, cold douche. Belladonna freely exhibited, of the tincture one drachm, or of the extract two grains every twenty minutes until free vomiting is established. Hypodermic injections of atropine, artificial respiration, strong coffee, active stimulants, decoction of galls, electro-magnetism, constant motion.
Savine.	High excitement, with acute pain in stomach and bowels, nausea and vomiting, hypercatharsis, convulsions, and in pregnant females abortion.	Emetics, copious dilutions with barley water, sedatives, emollients, opiates. Use suppositories of opium or belladonna, or morphine and atropine, hypodermically.
Silver, nitrate of.	Pains in stomach and abdomen, constriction and burning in throat, salivation, vomiting of bloody matter, diarrhœa, *respiration greatly embarrassed.*	Strong solution of common salt which converts it into chloride of silver, emetics, strict antiphlogistic treatment. Raw eggs and milk may be given freely.
Tin, salts of.	Vomiting, acute pain in the stomach, anxiety, restlessness, thirst, frequent hard and small pulse, increasing symptoms of violent irritation, delirium.	Free emesis, use of the stomach-pump. Albumen agitated with water, or milk in large quantities. Sodii carbonas and magnesia should also be administered.
Zinc, sulphate of.	Quickened pulse, pale and shrunken features, cold extremities. Death rarely follows, on account of the severe vomiting induced in the first instance.	Milk decomposes the poison, and should be administered in large quantities. Raw eggs and sodii carbonas or magnesia are also indicated.

TREATMENT OF PERSONS ASPHYXIATED FROM HANGING, DROWNING, AND THE INHALATION OF IRRESPIRABLE GASES.

Rules.

1. Treat the patient *instantly*, *on the spot*, in the *open air*, freely exposing the face, neck, and chest to the breeze, except in severe weather, and removing all tight clothing from the neck and chest. The points to be aimed at are, first and immediately, the restoration of respiration; and, secondly, after respiration is restored, the promotion of warmth and circulation. Efforts to accomplish the latter object, beyond removing wet clothing and drying the skin, must not be made until the first appearance of natural respiration.

2. *To restore Respiration.—Clear the throat* by placing the patient gently on the face with *one arm* under the forehead; all fluids and the tongue itself then fall forward and leave the entrance into the windpipe *free*. Assist this operation by wiping and cleansing the mouth. If there be only slight respiration, or no respiration, or if the respiration fail, then

3. *To excite Respiration.*—Turn the patient slightly on his side and apply some irritating or stimulating agent, as camphor or ammonia, *near* the nostrils (not *to* them), and dash cold water, or alternately cold and hot water, on the face and chest, previously rubbed briskly until warm. If satisfactory respiration commence, use the treatment prescribed below to promote warmth and circulation. If there be no success, lose no time, but proceed

4. *To imitate Respiration* (Marshall Hall's method) by replacing the patient on his face, raising and supporting the chest well on a folded coat or other article of dress, and turning the body gently but completely *on the side and a little beyond;* then again on the face, and so on alternately, occasionally varying the side. Repeat this movement deliberately and perseveringly *fifteen times only* in a minute. On each occasion that the body is replaced on the face, make uniform but efficient pressure with brisk movement along the spine between and below the scapulæ, removing the pressure immediately before turning the body on the side; during the whole operation, let one person attend solely to the movements of the head and the arm placed under it. While the above preparations are being proceeded with, dry the hands and feet, and, as soon as dry clothing or blankets can be procured, strip the body and cover or gradually reclothe it, but taking care not to interfere with the efforts to restore respiration. Should these efforts not prove successful in the course of from two to five minutes, proceed

5. *To imitate Respiration* (Sylvester's method) by placing the patient on the back on a flat surface, inclined a little upward from the feet; raise and support the head and shoulders on a small, firm cushion or folded article of dress, placed under the scapulæ. Draw forward the patient's tongue, and keep it projecting beyond the lips; an elastic band over the tongue and under the chin will answer this purpose, or a piece of string or tape may be tied round them, or by raising the lower jaw the teeth may be made to retain the tongue in that position. Take your place at the patient's head, grasp the arms just above the elbows, draw them gently and steadily upward above the head, and keep them stretched upward for two seconds. (By this means inspiration is effected.) Then turn down the patient's arms and press them gently and firmly for two seconds against the sides of the chest. (By this means expiration is effected.) Repeat the movements alternately, deliberately and perseveringly about fifteen times in a minute, until a spontaneous effort to respire is perceived, immediately upon which cease to imitate the movements of respiration, and proceed

6. *To induce Circulation and Warmth.*—Rub the limbs upward with firm, grasping pressure and energy, etc., the friction being continued under the blanket or over the dry clothing, which has been substituted, if possible, for the wet. Promote the warmth of the body by the application of hot flannels, bottles or bladders of hot water, heated bricks, etc., to the pit of the stomach, the arm-pits, between the thighs, and to the soles of the feet.

7. Meantime, and from time to time, if necessary, to *excite inspiration* let the surface of the body be *slapped* briskly with the hand, and cold water *dashed* freely on the surface, previously rubbed dry and warm.

8. If the patient has been carried to a house after respiration has been restored, be careful to let the air play freely about the room. On the restoration of life a teaspoonful of warm water should be given; and then, if the power of swallowing has returned, small quantities of wine, warm brandy and water, or coffee should be administered. The patient should be kept in bed, and a disposition to sleep encouraged.

Cautions.

1. Avoid the immediate removal of the patient, as it involves *a precious loss of time;* also the use of the bellows or any *forcing* instrument; also of the warm bath, except as a momentary excitant.

2. Avoid rough usage, and do not allow the body to remain on the back unless the tongue is secured.

3. Under no circumstances hold the body up by the feet or roll it with a barrel.

4. Prevent unnecessary crowding of persons around the body, especially if in an apartment or confined space.

Asphyxia Neonatorum.—Excite the skin by brandy or the cold (60°) and hot (100°) bath alternately in connection with the above *postural respiration*, rubbing *upward* with pressure, etc.

Practical Disinfection.

Chlorine Gas.—As an artificial disinfectant this agent has long been highly valued. The ingredients for producing it should be contained in saucers placed in the higher parts of the room, and great care should be taken, if the room be occupied, that the gas be not liberated in too great quantity.

One way of obtaining the gas is by the action of dilute sulphuric acid on a powder composed of equal parts of common salt and black oxide of manganese. Or it may be obtained from common salt alone, by pouring upon it concentrated sulphuric acid—one part of the acid to three of salt. Or by the addition of half a pint of hydrochloric acid, mixed with a quarter of a pint of water, to a quarter of a pound of finely powdered black oxide of manganese. Or, by exposing *chlorinated lime* to the air, the chlorine being disengaged by the carbonic acid of the atmosphere (with greater rapidity, by sulphuric acid).

Liquor Sodæ Chlorinatæ decomposes sulphuretted hydrogen; and may be sprinkled on the floor or bed in a sick-room, and added to the vessels intended to receive the excretions.

Solution of Chloride of Zinc.—Burnett's disinfecting fluid consists of 200 grains of this salt to f℥j of water. For use, one ounce of this solution should be added to two pints of water; a piece of flannel three to four feet square should then be moistened in this solution, and frequently waved through the air. Some of it should be placed in the closet-stools and bed-pans.

Quicklime possesses the power of absorbing many of the gases upon which the noisome atmosphere of the sick-room depends. It is placed on plates or dishes in various parts of the chamber.

Iodine.—It may be exposed in a solid form to the air, or volatilized by gentle heat on a fire-shovel. Very valuable, and easily managed.

Ozone.—On dead organic matter undergoing putrefaction, ozone acts rapidly. It can be obtained by moistening the interior of a large-mouthed glass vessel with old ether which has absorbed a good deal of oxygen, and plunging into the interior of the vessel a heated glass or iron rod. A glass jar thus ozonized will retain its properties and purify the atmosphere for several days. A more permanent source is to make the opaque olive-green mixture of two parts of permanganate of potassium with three parts of strong sulphuric acid. (Bœttger.) This, when exposed to the atmospheric oxygen, will give out ozone for a long time.

Nitric-Acid Vapor.—Half an ounce of nitrate of potassa treated with two drachms of sulphuric acid will disinfect a space of ten cubic feet.

Nitrous-Acid Vapor.—Made by pouring half a pound of oil of vitriol on two or three ounces of copper shavings.

Sulphurous-Acid Vapor.—Obtained by burning in a room several ounces of flowers of sulphur.

Carbolic Acid.—A most excellent disinfectant. The addition of two or three drops to a pint of freshly made urine has been found to prevent any chemical change for several weeks.

Sulphate of Iron.—This is one of the cheapest and best of disinfectants. When mixed with lime, the oxide of iron is liberated, which, by its affinity for additional oxygen, destroys effete matter.

A saturated solution of copperas and carbolic acid, scientific chemists and well-informed sanitary officers now agree, is at once the best and cheapest disinfectant against cholera.

Ledoyen's Disinfecting Fluid is a solution of nitrate of lead (ʒj–f℥j). It has, in common with solutions of sulphate of copper, nitrate of copper, chloride of copper, and other salts, the power of destroying the odor of sulphuretted hydrogen; they do not, however, prevent the putrefaction of animal substances.

Permanganate of Potassium.—This is an excellent disinfectant, and the basis of Condy's antiseptic fluid. A solution of the salt, from one to ten grains to the ounce, may be applied to all kinds of suppurating sores. Linen is stained by it; but the discoloration may be removed by sulphate of iron. To deprive night-chairs of offensive odor, mix a wine-glassful of Condy's fluid with two pints of fresh or salt water, and put into the pan previous to its use.

Perchloride of Iron is a good simple deodorizer, in solution of the strength of one to ten of water.

Wood and Peat Charcoal are powerful disinfectants.

Clay and Porous Earth act as true disinfectants.

Caustic Soda and Soda Ash.—The latter is said to be better than lime.

Heat, dry or in form of steam, to the temperature of 200° F. or more. This is the best means of disinfecting linen, etc., as it does not injure the clothes like chlorine, and is thoroughly efficacious.

Clay, the Ashes of Anthracite or Bituminous Coal, and Fresh Earth, are also valuable disinfectants.

The following summary of an article of Dr. T. Herbert Barker on disinfection is of importance to practitioners:

1. For the sick-room, *free ventilation*, when it can be secured, together with an even temperature, is all that can be required.

2. For rapid deodorization and disinfection, *chlorine* is the most effective agent known.

3. For steady and continuous effect, *ozone* is the best agent known.

4. In the absence of ozone, *iodine*, exposed in solid form to the air, is the best.

5. For the deodorization and disinfection of fluid and semi-fluid substances undergoing decomposition, *iodine* is the best.

6. For the deodorization and disinfection of solid bodies that can not be destroyed, a mixture of powdered chloride of zinc, or powdered sulphate of zinc with saw-dust, is best. After this, a mixture of carbolic acid and saw-dust ranks next in order, and, following on that, wood-ashes.

7. For the deodorization and disinfection of infected articles of clothing, etc., exposure to heat at 212° F. is the only true method.

8. For the deodorization and disinfection of substances that may be destroyed, heat to destruction is the true method.

The following disinfectants are most available for general use, and should be employed as directed, when such agents are required for the purposes indicated:

Privies.—*Sulphate of iron*, a pound dissolved in a gallon of water

same amount of *chloride of lime*, thoroughly mixed in water; or solution of *chloride of zinc*, six ounces to the gallon of water.

Water-Closets, Bed-Pans, etc.—Labarraque's solution of *chlorinated soda*, a fluidounce to the quart of water; or *permanganate of potassium*, ten grains to the quart of water; or carbolic acid, twenty grains to the pint of water. The preparation known as "Platt's Chlorides" is also an efficient disinfectant.

Drinking-Water.—Add (after filtration) enough *permanganate of potassium* to render it just perceptibly pink in a strong light.

Articles of Clothing.—If badly contaminated, burn. Otherwise, boil thoroughly. Solution of *permanganate of potassium* (an ounce to three gallons of water) is sometimes employed. But for this purpose "Boards of Health" regard the following mixture as perhaps the most valuable and reliable disinfectant in use: sulphate of zinc, eight ounces; chloride of sodium (common salt), four ounces; carbolic acid (crude), two ounces; warm rain-water, three gallons. All articles of body linen, sheets, etc., are to be thrown in this solution, and then boiled in clear water. In malignant cases of disease, such articles may be boiled in this solution with an equal quantity of water. It can be used freely in the sick-room. It does not stain. A towel may be saturated with it and hung in the apartment, or a sheet kept constantly wet with it may be hung across the entrance-hall or door. It may be used by nurses and attendants occasionally for washing their hands. Clothing which can not be boiled should be exposed for several hours to a dry heat of from 200° to 250° F.

Occupied Rooms.—Ventilation, spray of Ledoyen's liquid (solution) of *nitrate of lead*, solid *chloride of lime* in shallow vessels, weak solutions of carbolic acid.

Hospital Wards.—Ledoyen's liquid, chloride of lime, *bromine* left exposed to the air in shallow vessels, or iodine, heated moderately.

Heaps of Filth.—Cover with charcoal, or dry earth, two or three inches deep.

Drains, Ditches, and Sewers.—Sulphate of iron, coal-tar, chloride of lime, etc.

Report of committee of experts appointed by the National Board of Health to prepare a circular embodying instructions for disinfection: "The disinfectants to be used are: First, roll sulphur for fumigation; second, sulphate of iron (copperas) dissolved in water in the proportion of 1½ lb. to the gallon, for fæcal matters, sewers, etc.; third, sulphate of zinc and common salt, dissolved together in water, in the proportion of four ounces of each to the gallon, for clothing and bed-linen. In using disinfectants in the sick-room, the most available agents are fresh air and cleanliness. The towels, clothing, and bed-linen should, on removal from the patient and before they are taken from the room, be placed in a pail of zinc solution, boiling hot, if possible. All discharges should either be received into vessels containing copperas solution, or should be immediately covered with copperas solution. Fumigation with sulphur is the only practicable method of disinfecting the house. For this purpose the rooms must be vacated. Heavy clothing, bedding, blankets, and other articles which can not be treated with zinc solutions, should be opened and exposed during fumigation. Close the room as tightly as possible, place the sulphur in iron pans supported on bricks, in tubs holding a little water. Set the sulphur on fire and allow the room to remain closed for twenty-four hours. For a room about ten feet square, at least two pounds of sulphur should be used. Cellars, yards, stables, gutters, privies, cesspools, water-closets, drains, and sewers should be treated with copperas solution." These rules had especial reference to disinfection during the yellow-fever scourge of 1879. With slight modifications, they will apply to all cases of contagious or infectious disease.

Germicides.

While all authorities concede the value of sunshine and ventilation in the -ment of morbid conditions and surgical affections, yet there are many

who are convinced that "Listerism" is of no importance beyond the *systematic cleanliness* it involves. But to those who believe in the "germ theory," or the etiological influence of *microbes* or *bacteria* in the development and transmission of disease, the following conclusions of Dr. P. Miquel may be of interest:

He places oxygenized water, H_2O_2, at the head of the list of bactericides; 5 centigrammes to a liter of bouillon stopped all fermentation. The other agents have much less effect, as shown by the following figures, taken from a larger table given by Miquel.

The smallest quantity of each substance capable of preventing fermentation completely in one liter of bouillon was as follows:

Oxygenized water	0·05	gramme.
Iodine	0·25	"
Bromine	0·60	"
Chloride zinc	1·90	"
Carbolic acid	3·20	"
Permanganate potash	3·50	"
Boracic Acid	7·50	"
Salicylate soda	10·00	"
Borate soda	70·00	"
Anhydrous alcohol	95·00	"

If to this we add the almost absolute harmlessness of oxygenated water derived from baryta, we can understand what a rôle this re-agent is called upon to play in surgical and obstetrical operations.

According to Billroth, also, minute quantities of corrosive sublimate is our best germicide; for, according to his experiments in the prevention of bacteria-development, the table is as follows:

Corrosive sublimate	1	part	in	20,000
Thymol	1	"	"	2,000
Sodic benzoate	1	"	"	1,000
Creosote	1	"	"	1,000

Devaine shows that one part of *iodine* in 12,000 destroys the contagiousness of Charbon; that one part of the same in 10,000 of septic blood destroys its contagiousness.

The above experiments clearly indicate that *oxygenated water*, *iodine*, and *corrosive chloride of mercury* are the most certain germicides and antiseptics. The last-mentioned agent may be used in the proportion of one part to 8,000 of distilled water, or grs. viij to the gallon. A stronger solution of the strength of one part to 1,000, or grs. viij to the pint of water, is sometimes employed. These solutions should also contain grs. xx of chloride of sodium to the pint.

Doses of the Principal Officinal Drugs.

The following posological tables indicate the minimum and maximum doses of common and rare drugs for the adult patient. These doses are based mainly upon the suggestions of the United States Dispensatory, 1883, and the National Dispensatory, 1884. To facilitate reference, these agents are grouped according to their nature, form, or preparation, and in alphabetical order:

Note.—Preparations *in italics* are not officinal.

Abstracts.

Abstractum aconiti	gr. ½-1
belladonnæ	gr. ½-1
conii	grs. 1-2
digitalis	gr. ½-1
hyoscyami	grs. 2-3
ignatiæ	gr. ½-1
jalapæ	grs. 10-15
nucis vomicæ	grs. ½-1
Abstractum podophylli	grs. 5-10
senegæ	grs. 3-5
valerianæ	grs. 5-15

Aceta, or Vinegars.

Acetum lobeliæ	ʒ ½-4
opii	♏5-15
sanguinariæ	♏15-30
scillæ	♏15-

Acids, Mineral and Vegetable.

Acidum arseniosum	gr. $\frac{1}{24}$–$\frac{1}{16}$
benzoicum	grs. 10–30
boricum	grs. 10–30
carbolicum	gr. $\frac{1}{2}$–$1\frac{1}{2}$
gallicum	grs. 5–15
hydrobromicum dilutum	ʒ $\frac{1}{2}$–1
hydrochloricum dilutum	♏ 15–30
hydrocyanicum dilutum	♏ 2–4
lacticum	♏ 20–60
nitricum dilutum	♏ 10–30
nitrohydrochloric dil.	♏ 10–20
phosphoricum dil.	♏ 20 60
sulphuricum aromatic	♏ 10–20
sulphuricum dilutum	♏ 10–30
sulphurosum	ʒ 1–2
salicylicum	grs. 10-20
tannicum	grs. 3–10

Alkaline and Metallic Salts.

Alumen	grs. 10–60
Ammonii benzoas	grs. 10–30
carbonas	grs. 3–5
Antimonii et potassii tartras	grs. $\frac{1}{32}$–2
Argenti nitras	gr. $\frac{1}{4}$–$\frac{1}{2}$
Bismuthi subcarbonas	grs. 5–30
subnitras	grs. 5–30
et ammonii citras	grs. 1–3
Calcii phosphas, precipitatum	grs. 10–30
Cerii oxalas	grs. 1–2
Cupri sulphas	grs. $\frac{1}{4}$–5
Ferri ammonio citras	grs. 3–5
ammonio sulphas	grs. 5–10
ammonio tartras	grs. 10–30
arsenias	gr. $\frac{1}{10}$–$\frac{1}{8}$
carbonas saccharatus	grs. 5–30
citras	grs. 2–5
et potassii tartras	grs. 10–30
et quiniæ citras	grs. 3–6
et strychniæ citras	grs. 3–5
hypophosphis	grs. 4–12
lactas	grs. 3–5
oxalas	grs. 2–3
pyrophosphas	grs. 2–5
sulphas exsiccata	grs. 1–2
Hydrargyri subsulphas	grs. $\frac{1}{4}$–5
Lithii benzoas	grs. 15–30
carbonas	grs. 5–15
citras	grs. 10–30
salicylas	grs. 20-40
Magnesii carbonas	ʒ $\frac{1}{2}$-2
citras granulatus	ʒ 1–3
sulphas	℥ $\frac{1}{2}$–1
Mangani sulphas	grs. 5–20
Plumbi acetas	grs. 1–3
Potassii acetas	grs. 20–60
bicarbonas	grs. 20–60
bitartras	ʒ 1–2
chloras	grs. 10–20
citras	ʒ $\frac{1}{2}$–2
et sodii tartras	℥ $\frac{1}{2}$–1
sulphas	ʒ $\frac{1}{2}$–4
Sodii acetas	grs. 20–60
benzoas	ʒ 1–2
bicarbonas	grs. 5–60
boras	grs. 20–40
hypophosphis	grs. 10–30
salicylas	ʒ $\frac{1}{4}$–1
Zinci acetas	grs. 1–2
oxidum	grs. 2–8
sulphas	grs. 1–30
valerianas	grs. $\frac{1}{2}$–2

Active Neutral Principles.

Aloin	gr. $\frac{1}{10}$–$\frac{1}{5}$
Apiol	grs. 3–12
Elaterinum	gr. $\frac{1}{20}$–$\frac{1}{8}$
Picrotoxinum	gr. $\frac{1}{60}$–$\frac{1}{40}$
Piperina	grs. 1-10
Resorcinum	gr. 1–4
Salicinum	grs. 5–40
Santoninum	grs. $\frac{1}{2}$–5

Alkaloids and Alkaloid Salts.

Apomorphiniæ hydrochloras	gr. $\frac{1}{16}$–$\frac{1}{8}$
Atropinæ sulphas	gr. $\frac{1}{120}$–$\frac{1}{60}$
Berberiniæ sulphas	grs. 2–5
Caffeinæ citras	grs. 1–2
valerinas	grs. 1–2
Cinchoninæ sulphas	grs. 1–30
Cinchonidinæ sulphas	grs. 5–20
Codeinæ	gr. $\frac{1}{2}$–1
Digitaline	gr. $\frac{1}{60}$–$\frac{1}{20}$
Emetine	gr. $\frac{1}{8}$–$\frac{1}{4}$
Physostigminæ salicylas	gr. $\frac{1}{60}$–$\frac{1}{12}$
Hyoscyaminæ sulphas	gr. $\frac{1}{60}$–$\frac{1}{40}$
Morphinæ acetas	gr. $\frac{1}{8}$–$\frac{1}{2}$
hydrochloras	gr. $\frac{1}{8}$–$\frac{1}{2}$
sulphas	gr. $\frac{1}{8}$–$\frac{1}{2}$
Pelletierinæ tannas	grs. 5–10
Pilocarpinæ hydrochloras	gr. $\frac{1}{8}$–$\frac{1}{2}$
Quininæ bisulphas	grs. 1–20
hydrobromas	grs. 1–20
sulphas	grs. 1–20
valerinas	grs. 1–20
Strychninæ sulphas	gr. $\frac{1}{24}$–$\frac{1}{16}$

Aquæ, or Waters.

Aquæ camphoræ	℥ $\frac{1}{2}$-1
chlori	ʒ 1–4
chloroformi	℥ $\frac{1}{2}$–2
creasoti	ʒ 1–4

Confections.

Confectio opii	grs. 10–36
piperis	ʒ 1–2
scammonii	ʒ ½–1
sennæ	ʒ 1–2
sulphuris	ʒ 1–2
terebinthinæ	ʒ ½–1

Decoctions.

Decoctum aloes comp	℥ ½–2
cinchonæ flav	℥ ½–1
cornus	℥ ½–2
hæmatoxyli	℥ 1–2
quercus albæ	℥ 1–2
sarsaparilla, co	℥ 4–6
scoparii	℥ 2–4
taraxaci	℥ 1–2
uvæ ursi	℥ ½–2

Extracts (*Solid*).

Extractum aconiti	gr. 1/6–¼
aloes aquosum	grs. 2–10
anthemidi	grs. 2–10
belladonnæ alcoholic.	gr. ¼–½
columbæ	grs. 5–15
cannabis Indicæ	gr. ¼–½
cinchonæ	grs. 10–30
colchici radicis	grs. 1–2
colocynthidis comp.	grs. 5–30
conii alcoholicum	gr. ½–1
digitalis	gr. ¼–½
ergotæ	grs. 5–30
euonymi	grs. 1–3
gentianæ	grs. 10–30
glycyrrhizæ	grs. 10–30
hæmatoxyli	grs. 10–30
hyoscyami alc	grs. 1–2
iridis	grs. 1–2
jalapæ	grs. 10–20
juglandis	gr. 5–10
krameriæ	grs. 10–20
lactucarii	grs. 5–15
leptandræ	grs. 10–30
lupuli	grs. 10–30
nucis vomicæ	grs. ½–2
opii	gr. ½–1
physostigmatis	gr. 1/16–1/6
podophylli	grs. 1–3
quassiæ	grs. 1–2
rhei	grs. 5–10
stramonii	gr. ¼–½
taraxaci	grs. 20–60

Fluid Extracts.

Extractum aconiti fluidum	♏ ½–1
arnicæ rad. fluidum	♏ 5–10
aurantii amara fluidum	♏ 15–30
belladonnæ fluidum	♏ 1–2
brayeræ fluidum	℥ ½–1
buchu fluidum	ʒ ½–1
Extractum calumbæ fluidum	♏ 15–30
cannabis Indicæ fluidum	♏ ½–1
capsici fluidum	♏ ½–1
castaneæ fluidum	ʒ ½–2
chimaphilæ fluidum	ʒ ½–1
cimicifugæ fluidum	ʒ ½–1
cinchonæ fluidum	ʒ 1–2
colchici radicis fluidum	♏ 2–8
colchici seminis fluidum	♏ 2–8
conii fluidum	♏ 2–5
cornus fluidum	♏ 15–30
cubebæ fluidum	♏ 10–40
cypripedii fluidum	♏ 5–15
digitalis fluidum	♏ 1–2
ergotæ fluidum	ʒ ½–4
erythroxyli fluidum	ʒ ½–1
eucalypti fluidum	♏ 5–10
euonymi fluidum	ʒ ½–2
eupatorii fluidum	ʒ ½–1
frangulæ fluidum	♏ 15–30
gelsemii fluidum	♏ 2–8
gentianæ fluidum	♏ 10–30
geranii fluidum	ʒ ½–1
glycyrrhizæ fluidum	ʒ 1–4
gossypii radicis fluidum.	ʒ ½–1
grindeliæ fluidum	ʒ ½–1
guaranæ fluidum	ʒ 1–2
hamamelidis fluidum	♏ 15–30
hydrastis fluidum	ʒ 1–2
hyoscyami fluidum	♏ 3–5
ipecacuanhæ fluidum	♏ ½–30
iridis fluidum	♏ 5–10
krameriæ fluidum	♏ 10–60
lactucarii fluidum	♏ 5–30
leptandræ fluidum	♏ 20–60
lobeliæ fluidum	♏ 5–20
lupulinæ fluidum	♏ 10–15
matico fluidum	ʒ ½–1
mezerei fluidum	♏ 5–10
nucis vomicæ fluidum	♏ 3–5
pilocarpi fluidum	♏ 15–30
peponis fluidum	℥ ½–1
pruni Virginianæ fluidum	ʒ ½–1
quassiæ fluidum	♏ 5–10
rhei fluidum	♏ 5–30
rubi fluidum	ʒ ½–1
sabinæ fluidum	♏ 3–8
sarsaparilla comp.	ʒ ½–1
scillæ fluidum	♏ 1–3
senegæ fluidum	♏ 1–5
sennæ fluidum	ʒ 1–4
serpentariæ fluidum	♏ 20–30
spigeliæ et sennæ fld	ʒ 2–4
spigeliæ fluidum	ʒ 1–2
stillingiæ fluidum	♏ 15–45
stramonii fluidum	♏ 1–2
taraxaci fluidum	ʒ 1–3
uvæ ursi fluidum	ʒ ½–1
valerianæ fluidum	ʒ ½–1
veratri viridis fluidum	♏ 1–2

Extractum viburni fluidum.. ʒ ½-1
xanthoxylli fluidum.... ʒ ½-1
zingiberis fluidum...... ♏ 10-20

Glycerites.

Glyceritum acidi carbolici... ♏ 5-10
acidi gallici............ ♏ 20-60
acidi tannici........... ♏ 10-40

Haloid Salts.

Ammonii bromidum...... grs. 10-20
chloridum........... grs. 5-30
iodidum............. grs. 3-5
Calcii bromidum.......... ʒ ½-1
sulphidum........... gr. 1/10-½
Hydrargyri chloridum corros.................. gr. 1/16-⅛
Hydrargyri chloridum mite.................. gr. 1/10-10
Hydrargyri cyanidum.... gr. 1/16-⅛
iodidum rubrum..... gr. 1/16-¼
iodidum viride....... gr. ½-1
Lithii bromidum......... grs. 10-20
Potassi bromidum........ grs. 20-60
iodidum............. grs. 2-30
Sodii bromidum.......... grs. 20-60
chloridum........... ʒ 1-4
iodidum............. grs. 20-40
Zinci bromidum.......... gr. ½-1
iodidum............. grs. 1-2
phosphidum......... gr. 1/20-¼

Liquors.

Liquor acidi arseniosi...... ♏ 2-8
ammonii acetatis...... ℥ ½-1½
ammoniæ citratis...... ʒ 2-6
arsenici et hydrargyri iodidi.............. ♏ 5-10
calcis................. ℥ ½-2
calcis chloratæ......... ♏ 20-60
calcis saccharatus...... ʒ ½-2
ferri acetatis.......... ♏ 2-10
ferri chloridi.......... ♏ 2-10
ferri citratis.......... ♏ 5-10
ferri et quin. citratis... ♏ 10-20
ferri nitratis.......... ♏ 5-10
ferri subsulphatis...... ♏ 3-5
iodi compositus....... ♏ 3-5
morphinæ acetatis..... ♏ 15-30
morphinæ hydrochlor.. ♏ 15-30
potassæ.............. ♏ 2-30
potassii arsenitis...... ♏ 3-15
sodii arsenitis......... ♏ 3-5
sodii chloratæ........ ♏ 15-30
strychninæ............ ♏ 5-10

Infusions.

Infusum anthemidis......... ℥ 1-2
brayeræ................ ℥ 3-4
cohu.................. ℥ 1-2
Infusum calumbæ........... ℥ 1-2
cinchonæ.............. ℥ 1-2
digitalis.............. ʒ 2-4
eupatorii.............. ℥ ½-2
humuli................ ℥ 2-4
juniperi............... ℥ ½-2
quassiæ............... ʒ 1-3
sennæ................. ℥ 4-6
sennæ comp............. ℥ 2-4
serpentariæ........... ℥ ½-1
uvæ ursi.............. ℥ 1-2
zingiberis............ ℥ 2-4

Mixtures.

Mistura chloroformi......... ℥ ½-1
creasoti............... ℥ ½-1
cretæ.................. ʒ 2-4
ferri comp............. ℥ 1-2
ferri et ammon. acetatis.. ℥ ½-1
glycyrrhizæ comp....... ʒ 2-4
rhei et sodæ........... ʒ 1-4
sennæ comp............ ℥ ½-1

Oils, Fixed and Essential.

Oleum amygdalæ dulcis.... ʒ 1-4
anisi.................. ♏ 5-10
cajuputi............... ♏ 5-15
camphoræ.............. ♏ 2-3
cari.................. ♏ 1-10
caryophylli............ ♏ 2-5
chenopodii............ ♏ 5-10
cinnamomi............ ♏ 1-2
copaibæ.............. ♏ 10-15
cubebæ............... ♏ 5-10
erigerontis Canadensis.. ♏ 10-30
eucalypti............. ♏ 2-5
fœniculi.............. ♏ 5-10
gaultheriæ............ ♏ 1-3
hepatis morrhuæ....... ʒ 2-4
juniperi.............. ♏ 3-10
lavandulæ............ ♏ 1-5
lini.................. ℥ 1-2
menthæ pip........... ♏ 1-3
menthæ virid......... ♏ 1-3
myristicæ............ ♏ 1-2
olivæ................ ℥ 1-2
ricini................ ʒ 2-4
rutæ................. ♏ 1-3
sabinæ............... ♏ 1-3
terebinthinæ.......... ♏ 5-15
thymi................ ♏ 2-5
tiglii................ ♏ 1-2

Oleoresins.

Oleoresina aspidii.......... ʒ ½-1
capsici................ ♏ ¼-1
copaibæ............... ♏ 20-60
cubebæ............... ♏ 5-30
lupulinæ.............. grs. 2-5
piperis................ ♏ ¼-1
zingiberis............. ♏ ½-1

Powders.

Pulvis antimonialis	grs. 3-8
aromaticus	grs. 10-30
camphoræ	grs. 1-20
camphoræ monobromata	grs. 2-5
catechu comp	grs. 15-30
chinoidine dep	grs. 2-40
cretæ compositus	grs. 10-40
cretæ aromaticus	grs. 30-60
creta cum opio	grs. 10-20
cubebæ	ʒ ¼-3
ipecac. et opii	grs. 5-15
elaterii comp	gr. ½-5
ferri (reductum)	grs. 1-3
glycyrrhizæ comp	grs. 30-60
iodoformi	grs. 1-3
ipecacuanhæ	grs. ¼-20
ingluvin	grs. 5-10
jalapæ comp	ʒ ½-1
kino comp	grs. 5-20
lacto peptine	grs. 5-10
morphinæ comp	grs. 5-10
pancreatin sacch	grs. 5-10
opii	gr. ½-1½
rhei comp	grs. 30-60
scammonii comp	grs. 10-20

Resins.

Resina jalapæ	grs. 2-5
podophylli	gr. ⅛-½
scammonii	grs. 4-8

Spirits.

Spiritus ætheris	ʒ 1-3
ætheris comp	ʒ ½-2
ætheris nitrosi	ʒ ¼-4
ammoniæ aromaticus	ʒ ½-1
camphoræ	♏ 5-60
chloroformi	♏ 10-60
cinnamomi	♏ 10-20
gaultheriæ	♏ 10-20
juniperi	♏ 30-60
juniperi comp.	ʒ 2-4
lavandulæ	♏ 30-60
menthæ pip	♏ 10-20
menthæ virid	♏ 15-20

Syrups.

Syrupus acidi hydriodici	♏ 20-40
aurantii	ʒ 1-2
calcis	ʒ ½-1
calcis lactophosph	ʒ 2-4
chloralhydrate	ʒ 1-2
ferri bromidi	ʒ ½-1
ferri iodidi	♏ 15-30
hypophosphitum	ʒ 1-2
hypophosph. cum ferro.	ʒ 1-2
ipecacuanhæ	ʒ ½-4
krameriæ	ʒ 2-4
Syrupus lactucarii	ʒ 2-3
picis liquida	ʒ 1-2
pruni Virginianæ	ʒ 2-4
rhamni	ʒ ½-1
rhei	ʒ 1-4
rhei aromatic	ʒ 1-4
rubi	ʒ 1-2
sarsaparillæ comp	ʒ 2-4
scillæ	ʒ ½-1
scillæ comp	ʒ ½-4
senegæ	ʒ 1-2
sennæ	ʒ 1-4
stillingiæ comp	ʒ 1-4
tolutanus	ʒ 1-4
zingiberis	ʒ 1-4

Tinctures.

Tinctura aconiti	♏ 1-2
aloes	ʒ ½-4
aloes et myrrh	ʒ 1-2
arnicæ florum	♏ 10-30
arnicæ radicis	♏ 20-30
aurantii dulces	ʒ 1-2
aurantii amari	ʒ 1-2
asafœtidæ	ʒ ½-1
belladonnæ	♏ 5-10
benzoini comp	ʒ ½-1
bryoniæ	ʒ ½-1
buchu	ʒ 1-4
calumbæ	ʒ 1-2
cannabis Indicæ	♏ 10-60
cantharidis	♏ 2-5
capsici	ʒ ½-1
cardamomi	ʒ ½-1
cardamomi comp	ʒ 1-2
castorei	ʒ ½-2
catechu comp	ʒ ½-3
chloroformi comp	♏ 20-60
cimicifugæ	ʒ ½-4
cinchonæ comp	ʒ 1-4
cinnamomi	ʒ 1-4
colchici	♏ 10-30
conii	♏ 10-30
cubebæ	ʒ 1-2
digitalis	♏ 5-20
ferri acetatis	♏ 15-60
ferri chloridi	♏ 10-40
gentianæ comp	ʒ 1-2
gelsemii	♏ 10-20
guaiaci	ʒ 1-2
guaiaci ammon	ʒ 1-2
humuli	ʒ 1-3
hydrastis	ʒ ½-1
hyoscyami	ʒ ½-1
iodi	♏ 3-10
ipecac et opii	ʒ ½-1
jalapæ	ʒ 1-2
kino	ʒ 1-2
krameriæ	ʒ 1-2
lavandulæ comp	ʒ ½-1

Tinctura lobeliæ	ʒ ½-1
matico	ʒ ½-1
moschi	ʒ ½-2
nucis vomicæ	♏ 10-20
opii	♏ 5-15
opii camphorata	ʒ 1-4
opii deodorata	♏ 5-15
physostigmatis	♏ 10-20
quassiæ	ʒ ½-1
quininæ	ʒ ½-1
rhei	ʒ 1-2
rhei aromatica	ʒ ½-1
scillæ	♏ 10-20
sennæ	ʒ ½-1
serpentariæ	ʒ 1-4
stramonii	♏ 20-30
valerianæ	ʒ 1-4
valerianæ ammon	ʒ ½-1
veratri viridis	♏ 3-8
zingiberis	♏ 8-40

Troches.

Trochisci acidi tannici	dose 1-3
ammonii chloridi	dose 1-3
Trochisci catechu	dose 2-5
cubebæ	dose 5-10
ferri	dose 1-3
glycyrrhiz et opii	dose 5-10
ipecacuanhæ	dose 1-2
menthæ pip	dose 1-3
morphinæ et ipecac	dose 5-10
potassii chloratis	dose 1-4
sodii bicarbonatis	dose 2-10
sodii santoninatis	dose 1-4
zingiberis	dose 3-5

Vina, or Wines.

Vinum aloes	ʒ 1-8
antimonii	♏ 10-60
colchici radicis	♏ 10-60
colchici seminis	ʒ ½-2
ergotæ	ʒ 1-4
ferri amarum	ʒ 2-4
ferri citratis	ʒ 1-2
ipecacuanhæ	ʒ ½-8
opii	♏ 5-15
rhei	ʒ 1-4

CLINICAL RETROSPECT.

The concluding pages of this work are designed to afford a brief *Therapeutic Repertory*, or Clinical Review, relating mainly to the salient points of treatment of the more common and the more important diseases and morbid conditions coming under the physician's care.

Speaking generally, the plans of treatment and the accompanying formulæ are such as are recognized and recommended by many of the leading authorities of the day. In their selection or presentation, as well as in supplemental observations, the author has been governed largely by his own professional experience.

The reader should, however, bear in mind that the following prescriptions are not intended as *arbitrary*, but are merely *suggestive* of application in the majority of cases. In actual practice, each affection should be studied and treated independently, and in accordance with the judgment of the prescriber, which must be based upon the real condition and susceptibility of the patient. The necessity of resorting to stereotyped formula or routine treatment in the management of disease will be less in proportion as the principles of pathology and of therapeutics are well understood. In cases of doubt, however, the value of clinical memoranda, arranged for ready reference, is conceded.

I. Diseases of the Digestive System.

Anorexia.—Loss of appetite is a common symptom of disease, and must be met by the indications of each case. Various cholagogue purgatives, especially mercurial, are often of primary importance. They may be taken at night, and followed by saline cathartics next morning. The various tonic remedies, such as quinine, nux vomica, the simple bitters, and mineral acids, are to be tried in succession. In convalescence from disease, and in low conditions of the system, diluted nitro-hydrochloric acid with comp. tinct. of cinchona is of great value. The bicarbonate of soda with cold infusion of hops, or tinct. ferri chloridi, and sulphate of quinine, are reckoned among the surest appetizers. The following is also worthy of trial: ℞ Tr. nucis vomicæ, tr. rri chloridi, and acid phosph. dil., āā ʒ iv; syrupi zingiberis, ℥ jss. M. Teaoonful in water at meal-times. If the anorexia be complete, or nearly so

(as may be the case with hysterical girls), systematic efforts to administer food are necessary; and if persuasion will not succeed, either compulsion must be resorted to, or liquid food be introduced by means of the stomach-tube. Rectal alimentation is a resource, if the foregoing means be not practicable. At the same time, measures of treatment addressed to the mind and nervous system are essential. These consist of life in the open air, change of scene, the sponge-bath, the wet pack, and the use of the bromides.

Vomiting.—"This affection, like anorexia, from a clinical standpoint, under certain circumstances, may be considered as an individual morbid condition. The circumstances, in most cases, are similar to those under which functional anorexia occurs, and the latter is usually conjoined. It is an affection almost peculiar to women, analogous cases in men being extremely rare. Girls near the age of puberty are affected much oftener than women after this period of life; but the latter are not exempt from it. The vomiting proceeds from an intolerance of food by the stomach. It can not be said that the vomiting is due to either dyspepsia or indigestion, for the aliment does not remain in the stomach long enough for the commencement of the digestive process. This form of vomiting may, with propriety, be classed among the neurosal affections. In respect of its neuropathic character, it is analogous to the vomiting which frequently attends pregnancy. The affection is often persistent, and, especially as regards medicinal treatment, intractable. The remedies which relieve vomiting in other connections are rarely effective. They should, however, be fairly tried. Trial should be persistently made of different kinds of food, prepared in different ways, in the hope of finding something which the stomach will tolerate; and any kind of food to which the patient may be inclined should be allowed without regard to its digestibility. A method which sometimes succeeds is to give food in very small quantity at a time at intervals of a few moments. Skimmed-milk, buttermilk, and raw meat, given in this way, are most likely to be retained when other forms of nourishment are rejected. If the efforts to overcome the intolerance of food by the stomach fail, rectal alimentation may be resorted to." The requirements of nutrition can be met by the use of "*beef. peptonoids*" and other nutritive injections. Hygienic treatment addressed to the mind and nervous system is important. When the stomach resumes the exercise of its digestive functions, remedies to improve digestion, nerve tonics, and chalybeates are indicated. In the vomiting from gastric irritation, the best remedies are bismuthi subnitras, with dilute hydrocyanic acid, aquæ creasoti in small doses, with or without liquor calcis. If obstinate, morphine hypodermically. Leeches or blisters may be applied to the epigastrium. In the morning vomiting of drunkards, small doses of *Fowler's solution* is sometimes efficient. In gestal vomiting, oxalate of cerium, chloroform, bromide of potassium, or infusion of calumba, may be tried. In these cases, wine of ipecac. in drop doses, every hour or thrice daily, will often succeed. Suppositories of belladonna and morphine, *per vaginæ* or *rectum*, are often of service. Erosions of the cervix uteri should be healed by the topical application of nitrate of silver, or iodoform.

Dyspepsia.—In this affection, "the patient should be instructed to eat of wholesome articles of food, whatever is most desired, and in quantity to satisfy the appetite without regard to any system founded on particular notions regarding the digestibility of different kinds of food." In other words, the diet should be in accordance with the dictates of appetite and taste. Medicinal remedies are not without utility. The uncomfortable sensations after eating, in some cases of dyspepsia, are relieved by alcoholic stimulants. They should, however, rarely be recommended, especially in *chronic dyspepsia*, owing to the liability of patients becoming addicted to their use beyond sanitary limits. The following is a useful combination: ℞ Pulv. ipecac., gr. vj; pepsini saccharati, ʒj. M. Ft. Chart. No. XII. One after meals. If there is morbid sensibility, pills of nitrate of silver and ext. hyoscyami may be administered at bed-time. In irritable dyspepsia with gastrodynia, pyrosis, or chronic vomiting, oxalate of cerium should be tried. To

a cold bath is to *greatly increase* the blood-pressure, and this in turn demands an *increase of cardiac power*, in order that the circulation be properly carried on. It is a well-known fact that sudden distention of the heart causes paralysis of that organ; and that this result can be brought about by a distensile force, which is weak in proportion as the heart itself is weak. Other things being equal, increased blood-pressure predisposes to hæmorrhage and calls for more expenditure of heart-force. In a case with an already weakened heart, with the mesenteric vessels ulcerated nearly through, or perhaps entirely so, and the opening closed by friable clots, it is easy to imagine how and why the cold bath might produce either fatal syncope, pulmonary congestion, or hæmorrhage from the bowels. Large doses of quinine induce similar effects." They are not only capable of paralyzing a weak heart, but also increase the tendency to hæmorrhage. Epistaxis and metrorrhagia are common effects of full doses of this agent. "Some ladies can not take ten grains of this drug during menstruation without bringing on alarming hæmorrhage. That quinine often increases and prolongs the flow after labor is a fact that has also been noted. In view of these facts, one is forced to the conclusion that the indiscriminate or general use of the cold bath, and large doses of quinine, in enteric fever, either separately or in conjunction, are measures of treatment unsupported by theory or clinical facts, and, as a routine procedure, must often be productive of harm. Not that these agents are to be entirely discarded, for they may not only be admissible, but even demanded in those cases with high fever, strong heart-action, and where there is no evidence of extensive ulceration of the bowel, especially during the first week of the disease. But during the second and first part of the third week, when hæmorrhage is most likely to occur, these measures, if used at all, must be employed with the greatest caution. After hæmorrhage has once occurred, or when we have reason to believe that there is extensive ulceration of the bowel, and in cases where the action of the heart is feeble, or there is marked pulmonary congestion, the cold bath and quinine treatment combined, or the cold bath itself, should not be employed. A careful study of the history of typhoid fever teaches that there is no *one element* of the disease which can be distinctly recognized as *the element* of danger in all cases, or even in a majority of them. For this reason, to adopt a given treatment for all, or even a principal number of cases, is contrary to the nature of the disease, and must be regarded as injudicious and reprehensible. Each individual case should be studied by itself and treated accordingly, for what is an element of danger in one case may be in another of the most trivial import. Again, means which might be employed with propriety to subdue a certain dangerous symptom in one case, would, in others, cause a more dangerous one than that for which they were employed. There is great danger of commencing the use of stimulants too early, and thus exhausting the power of the heart to respond to these remedies, or getting the after-effects of stimulation (exhaustion), when stimulation is most needed." This, however, does not apply to the frequent use of small quantities of alcoholic stimulants with milk to assist its digestion and assimilation. This may be, in fact, justifiable from the beginning and throughout the disease, and may even prevent the occurrence of adynamic symptoms. "Some authors place great stress upon the utility of the nervous sedatives for the delirium, while others, for the same symptoms, use stimulants and exclude almost entirely the sedatives. This shows again the importance of making each case a separate study; for in one case the delirium may be due to excitation, and in another to exhaustion of the nerve-centers; and hence sedatives would be indicated in the one, and stimulants with alimentation in the other."

With this general idea of the nature and indications of enteric fever, the ordinary management may be summarized as follows: Any time within the first nine days of the attack, cathartic doses of calomel may be given for two or three alternate days. This agent is recommended at the outset of typhoid fever, not from the recently demonstrated antiseptic properties of mercurials, but from its well-known eliminant properties by which the principal glandu-

lar organs are stimulated to rid the system of "waste" products. German statistics and general experience show that this treatment shortens the disease and moderates the violence of its symptoms. If the temperature is excessive, quininæ sulphas, gr. xv–xx, may be given on each alternate night during the first week of the disease. After this we should rely upon the mineral acids, saturated solution of potassii chloras, small doses of tr. opii, liquid alimentation (milk chiefly), alcoholic stimulants, and frequent sponging of the surface of the body with tepid water, to which vinegar may be added. Acids are indicated from superalkalinity of the blood, and from the lack or entire absence of free acids in the gastric juice of those suffering from this malady. They are excellent refrigerants. The functions of the kidneys should be carefully maintained, for which abundance of water should be allowed throughout the malady. If perforation of the bowels occur, large doses of opium should be given. If intestinal hæmorrhage take place, ext. ergot fluid or plumbi acetas and opium should be given. "Remedies given with the view of their local astringent effect should be administered in pill form or in capsules. Filling the large intestine with hot water has been found a potent remedy in those cases where there is great abdominal tenderness, and is considered one of the best means for controlling severe hæmorrhage, its use being suggested from its local anæsthetic and hæmostatic effects in other affections of the bowels, as enteritis, hæmorrhoids, dysentery, etc." If diarrhœa is excessive, it is usually controlled by aromatic sulphuric acid and tinct. of opium, and, if this is insufficient, emulsion of turpentine, with bismuthi, subnitras, and laudanum, is generally sufficient.

Erysipelatous Fever.—This affection is no longer regarded as a local disease. It is constitutional, and the result of blood-poisoning. At the outset, if there is constipation and a coated tongue, a cathartic dose of calomel and ipecac, followed by castor-oil and turpentine until the bowels are freely moved, is a measure of primary importance. Then the patient should be placed at once upon the following: ℞ Tr. ferri chloridi, spts. chloroformi, glycerini, āā ℥j; aquæ, ℥iij. M. Dose, tablespoonful in a wine-glass of water every four hours until the symptoms abate, after which the dose should be reduced, but continued throughout the disease. In some cases large doses of quinine have arrested the disease: ℞ Quininæ sulph., gr. xx; acid sulph. dil., ♏v; tr. opii, ♏x; aquæ, ℥jss. M. To be taken at one dose at bedtime. If the stomach is irritable, a mustard plaster should be placed over the epigastrium for ten or fifteen minutes before giving the quinine, or else it may be administered by enema. In cases not seen sufficiently early, a repetition of the dose on the second or third night may be required. The iodide of potassium has also been found of great value in this affection: ℞ Potassii iodidi, ʒj; aquæ, syrupi, āā ℥j; tinct. gaultheriæ, ʒss. M. Dose, teaspoonful in water every two hours. When the violence of the disease is subdued, a less quantity is given. If there is much prostration, quininæ sulph., gr. ij, with whisky (℥ss. to ℥j), should be given three or four times a day. Milk and animal broths are also called for. As an external soothing application, the following is most suitable: ℞ Plumbi acetatis, ʒj; aquæ, glycerini, ext. belladon., fluid, āā ℥j. M. With this the parts are to be kept moist. Equal parts of tr. ferri chloridi and alcohol make a good application, or the sulphate of iron in the proportion of ʒj to water Oj may be applied by saturated cloths. Where the inflammation is high, the tension great, or when pus is present or gangrene threatening, incisions should be freely and boldly made into the cellular tissue.

Cerebro-Spinal Fever.—At the outset of this malady, in order to lessen and prevent serous effusion, active hydragogue purgatives should be given: ℞ Trituratio. elaterini, ℈j; hydrarg. chlorid. mite, ℈ij; ext. jalapæ, ʒj. M. Ft. Pil. No. XX. Dose, one every four hours until the bowels are thoroughly purged. If much prostration is induced, alcoholic stimulants may be alternately given. Cantharidal vesicants should also be used to the back of the neck and the spine. Opium in large doses should be given to relieve pain, and chloralhydrate in quantities sufficient to quiet delirium. If the

patient is comatose, ol. tiglii with ol. ricini should be used by enema. In this condition atropine hypodermically may be strongly indicated. If quinine is given, it should be in conjunction with ergot or hydrobromic acid. In the latter stages and during convalescence, iodide of potassium is highly esteemed: ℞ Potassii iodidi, ʒ ij; tr. cinch. comp., ℥ iij. M. Dose, teaspoonful in water after meals. Nutritious aliment and the strictest hygiene are of importance throughout the attack and through convalescence.

Rheumatic Fever.—It is generally best to give cholagogue purgatives at the outset of this disease, and maintain a free daily action of the bowels afterward by the use of Rochelle salts. To moderate the fever, good results are often obtained by the use of tr. aconite in drop doses every hour or two hours. Vinum colchici, ♏xv–xx, may be given twice or thrice daily. In anæmic cases, tr. ferri chloridi, ♏xx–xxx, every six hours, is of great value. Opium should be given in doses sufficient to relieve pain. *Pulv. Doveri*, from its anodyne and diaphoretic effect, is especially useful. Potassii bicarb., grs. xxx, in flavored syrup or in effervescing solution, every four hours, until the joint symptoms are relieved, is often good treatment. The following formula, in the majority of cases, constitutes the best remedy: ℞ Sodii salicylatis, potassii iodidi, āā ʒ iv; syrup. aurantii, ℥ vj. M. Dose, tablespoonful every four hours until relief is obtained, then smaller doses at longer intervals.

Variola.—In the forming stage of this malady, potassii bitartras or sodii et pot. tartras should be given. To moderate the fever, frequent sponging with tepid water to which soda bicarb. is added, and the use of arterial sedatives and anodynes, especially Dover's powders, at night, are also usually required. If the temperature is hyperpyrexic, graduated cold baths and quinine in antipyretic doses may be required. During the suppurative stage, alcoholic stimulants—milk-punch, egg-nog—should be given according to manifest depression. Chloralhydrate is highly useful and necessary when a high temperature is accompanied by wakefulness and delirium. For the insomnia and delirium, with adynamia during the latter stages, opium is the better remedy. To prevent the pustules from "pitting," tinct. of iodine is generally applied. Irritation of the skin requires oleaginous inunctions. The *unguentum petrolei* is usually employed.

The Inflammatory Process.—The management of this condition relates to its local and constitutional treatment. Of *local* measures, a primary indication is to remove all sources of irritation, and after this to place the affected parts in a state of complete repose—*of actual rest, mechanical or physiological.* In addition to this, elevation of the part when possible, the local abstraction of blood by scarification, puncture, leeching or cupping, compression by the bandage, or adhesive plaster; destructives, as the use of the cautery to poisoned wounds; counter-irritants, especially blisters and the local application of astringents, are reckoned the most useful measures. The benefit of local blood-letting in an early stage of inflammation can not be questioned, and is probably due to its relieving the condition of stagnation and permitting freer circulation of blood in the part. Cold may be regarded as a typical astringent. When the vascular disturbance—that is, hyperæmia—is active and the general fever high, cold, produced either by ice or evaporation, is generally the best treatment. Clinical experience has demonstrated, in case of mechanical injuries, that, if an injured part be kept cold *during the period of reaction*, the inflammation is less severe. In the application of this agent, care should be taken to preserve an even temperature, and not, by intermission of the application, to allow reaction to take place. Cold is also a powerful nervous sedative, and reduces the nervous irritability of inflamed parts. "When the condition of stasis with exudation is set up, the benefit of cold is less marked; and, if temporary amelioration is produced, the condition, after the application is stopped, may be ᴀs bad as ever, or perhaps worse. The defect of cold as an 'antiphlogistic' ·ms to be that—though it reduces hyperæmia, and, if sufficiently intense, ᴀally checks inflammation—*it does not remove the condition of the vascular*

walls on which stasis and the associated changes depend." Dry cold has the advantage of not soddening the part, and is less apt to be followed by gangrene. It is best applied by putting ice into a thin vulcanized India-rubber bag, or by applying a mixture of ice and salt in a glass tumbler, covered by a piece of bladder or oil-silk. In employing cold water, the part should be exposed to favor evaporation. Cold affusions should never be employed when there is any sense of chilliness, although the thermometer indicates a morbid degree of heat. They should never be employed when the body is in a profuse perspiration, nor in fever complicated with any *visceral* inflammation. The earlier in the disease they are resorted to, the better the effect; but in the more advanced stages they sometimes moderate the symptoms. When ice can not be obtained, water may be rendered cold by the addition of one sixth its bulk of alcohol, or by ammonii chloridum and potassii nitras. In *sprains*, *bruises*, *blows*, or *orchitis*, and local external inflammations generally, which do not break the skin, but are followed by ecchymosis, suggillation, swelling, and pain, the following cooling and discutient lotions, from the evaporation induced, are especially useful: ℞ Ammonii chloridi, ʒ v; acidi acetici, alcoholis, āā ʒ x; aquæ, q. s. ad ℥ x. M. For inflamed joints the following may be employed: ℞ Camphoræ, ℈ij; saponis, ʒ jss.; ammonii chloridi, ʒ ijss.; alcoholis diluti, ℥ v. M. S. Immerse a piece of flannel in this solution and retain it upon the inflamed part by means of a bandage. Water may be rendered anodyne, astringent, or antiseptic by the addition of opium, acetate of lead, or some of the chlorides. In this connection it should also be noted that an effect like that of cold is produced by solutions of certain *metallic salts*, especially those of lead, zinc, silver, and bismuth. "These salts furnish the most certain and direct means of treating an inflammation in parts actually accessible to their action. Hence they are employed in superficial inflammations of the mucous membranes, such as the digestive mucous membrane and the conjunctiva, and of the skin. Their use is limited by the difficulty of bringing them in actual contact with deeper inflamed parts." Astringents act more powerfully on the exudative process than on the vascular disturbance. "Hence their activity is most valuable when that of cold is ended, and they exert a marked effect on chronic inflammations which are unaffected by cold. Even *pressure* may be useful as an astringent, as we see in strapping a testicle or an inflamed joint. In the application of all astringents it is of the first importance to be sure that they actually reach the inflamed part." In the application of ice to the chest for pneumonia, or pericarditis, for instance, this result is very doubtful.

In the treatment of even acute inflammation, the precisely opposite application, that of *heat*, is sometimes valuable. Some authorities prefer *warm* to cold water. Others consult the feelings of the patient, and employ that which is more agreeable. "If it were possible to apply a temperature high enough to destroy *leucocytes*, it is probable that most inflammations might be suddenly brought to an end. Almost the only instance of this is the cure of whitlow on the finger, by plunging it into hot water—a treatment which would be more satisfactory if the necessary temperature were precisely fixed." Marked relief is also sometimes afforded when it is practicable to immerse sprained joints in hot water, or when the latter is applied, by means of sponges, fomentations, or the douche, to parts within reach of its application. "*Heat*, combined with *moisture*, is the type of an *emollient* by which the substance of inflamed tissue is relaxed, the blood-vessels dilated, the sense of tension and nervous irritation removed; and, though exudative processes are probably promoted, yet the *mechanical* condition of stasis is relieved, and resolution is thus hastened. When pus is forming, there is little doubt that heat and moisture (in the form of poultices and fomentations) hasten the process, and increase the amount of pus formed; but the amount of pus is often of no great consequence, and it is often of more importance to hasten the process. Thus, it may be the right treatment for suppuration. When pus is once formed, the same treatment is useful in guiding it in the direction in whi

it is the least hurtful. Finally, it may be beneficial to apply heat and moisture superficially, to relieve deep-seated organs, by stimulating the vascular and lymphatic circulation through the skin." Thus, in applying poultices for pneumonia, it is not the intention to render the lung, or even the pleura, hotter; but to relieve the overloaded blood-vessels and lymphatics, which are deep-seated, by the dilatation of those which are superficial.

In treating all superficial inflammations, we must guard against anything which may increase the injury, such as movement, further irritation by the air, or anything contained in the air. Thus, in some skin diseases, secondary inflammation is prevented by *protectives*. Antiseptic surgery is based on the assumption that it is not the air; but something in the air which is to be feared, and, if this is excluded, much inflammation is prevented. The local effects of narcotic applications are often exceedingly grateful. An aqueous solution of *opium* will often strikingly soothe the irritated nerves of a part. Extract of belladonna and glycerine, applied locally, causes constriction of the vessels, diminishes the supply of blood, and obtunds nervous sensibility, and in these ways often gives marked relief. In injuries of the eye, a solution of *atropine*, grs. v to water ℥j, applied with a wet rag, will subdue promptly intense neuralgia and other forms of pain. A five-per-cent solution of the newly discovered alkaloid, *cocaine*, is now extensively used for similar purposes.

The *constitutional* treatment of acute inflammation has reference to the employment of measures with the view of reducing the intensity either of the local reaction or of the fever. Among therapeutic measures, the chief are general blood-letting, the general application of cold, and the use of certain drugs called vascular depressants, such as mercurials, antimonials, purgatives, quinine, and a number of others. Under this heading, a restriction of diet is of primary importance, as there is little doubt that the intensity of all inflammations (especially of a sthenic type) is lessened by greatly diminishing the amount of food taken.

The late Professor S. D. Gross believed that venesection is demanded whenever there is a hard, strong, full, and frequent pulse, a plethoric state of the system, and great intensity of morbid action; but that extreme youth or age, corpulence, the nervous temperament, exhausted states of the system, exanthematous diseases, and the depression incident to grave accidents, are circumstances which either call for great caution, or else prohibit the use of this measure. There can be no doubt that general blood-letting often lowers the energy of inflammatory processes in an early stage. Of cold-baths, we need but state that they are far more potent in checking the condition of fever than in stopping local inflammation. Cathartics are especially valuable in inflammation of the brain and its membranes, the eye, ear, throat, liver, skin, joints, and the respiratory organs. They are generally contra-indicated in gastritis, enteritis, peritonitis, cystitis, wounds of the intestines, and strangulated hernia. Of direct vascular depressants (cardiac sedatives), aconite, "tartar emetic," veratrum viride, gelsemium, chloralhydrate, and "Dover's" powders, are most useful. They may have little local effect, but greatly modify the febrile state. Aconite has been lauded as a powerful depressant and "antiphlogistic" in gouty and rheumatic inflammations, in high traumatic fever, in erysipelas, and in the inflammation which sometimes follows vaccination. It is contra-indicated where the intestinal mucous membrane is inflamed. In gonorrhœa and orchitis it is very useful, and in the reflex fever which sometimes follows catheterism. The following is an excellent combination: ℞ Tr. aconiti, gtt. xvj; spts. ætheris nitrosi, ℥ ij; mistura potassii citratis, ℥ vj. M. Dose, tablespoonful every two hours. Where there is much reflex nervous excitement, the following is efficient: ℞ Tr. aconiti, ʒ ss.; potassii bromidi, ℥ ss.; *syrupi Doveri* (Gregory's), ℥ ij. M. Dose, teaspoonful every two or three hours. As an antiphlogistic, "tartar emetic" should be given in doses of gr. 1/6 to 1/4, and frequently repeated. Its effects are greatly enhanced by the addition of a small quantity of morphine. Tr. veratri viridis is an important depressant. As a

preventive of inflammation after any severe injury it is invaluable. The tincture should be administered very carefully, so as to keep the pulse depressed as much as possible, but at the same time to avoid vomiting. To secure this effect, especially after severe abdominal injuries, it should be combined with opium. Gelsemium produces a marked fall of temperature, and is highy useful in sthenic inflammation. Chloralhydrate diminishes the coagulability of the fibrin of the blood, and allays cerebral excitement. Its use is indicated where the temperature is high, and when restlessness and delirium are present. As a preventive measure against inflammation, and to secure quiet repose of the system, to relieve pain, and to induce sleep, opium or its derivatives are almost indispensable. In peritonitis, large and repeated doses are demanded; but no form of this drug should be given in inflammation of the kidneys, and only with great caution where the lungs are involved. "Quinine is thought (on theoretical and experimental grounds) to check the emigration of leucocytes, and to kill organized bodies or germs resembling *bacteria*. The first belief is experimentally true if the drug is in a certain degree of concentration; but we have no safe way of introducing it in this degree of concentration in the blood. Alcohol has been recommended as an antiphlogistic, on the ground that it lowers the temperature in health. But even this is not constant, and there is no good reason for thinking that it has this effect in fevers, still less that it checks the inflammatory process. If alcohol be given, it should be on other grounds. Thymol, salicylic and carbolic acid, are lauded as destroying supposed *fever germs;* but, as with quinine, we can not get them into the blood in sufficient concentration, and, if we could, it is probable that other more serious disturbances would be produced. The conclusion must be that there is no one drug given internally which is capable of controlling local processes of inflammation, though the attendant suffering and the resulting condition of fever may be greatly modified." It should, however, be stated that many eminent authorities still believe that the value of *mercurials* in inflammation—both during its height to arrest its progress, and later to promote absorption—is very great. In inflammation affecting the fibrous and the fibro-serous tissues—in synovitis, endocarditis, pericarditis, arteritis, hepatitis, periostitis, laryngitis, orchitis, iritis, and syphilis—it is of most utility. When a prompt and powerful impression is desired, calomel, in doses of gr. iij to v every three, six, or eight hours, should be given until we have obtained the object of its exhibition. If the skin is hot and dry, tartar emetic, ipecac, or Dover's powders may be added to this agent. As a *sorbefacient* in chronic cases, calomel should be administered in fractional doses of a grain and in a persistent manner, the gums being merely touched. For this purpose the *bichloride of mercury* or *blue mass* may also be given in small doses. Contra-indications to the use of mercury are age, anæmia, and the strumous habit.

In inflammations of the membranes and organs accompanying diseases, such as pneumonia and that which is incident to various forms of fever, whether contagious or otherwise, there is almost always a want of saline constituents of the blood, the result of "waste," and this condition must be remedied by the administration of saline medicines, such as the bicarbonate of sodium and of potassium. In fevers generally, the parched condition of the mouth and throat, and dryness of the skin, are caused by a want of secretion of the mucous follicles as well as excretion of the sudoriparous glands of the skin. To restore healthy action in this condition, saline preparations, in conjunction with the free administration of water, is a measure strongly indicated.

In most cases a combination of the foregoing agents may be given with advantage. For this purpose the following *antimonial and saline mixture* of the late Dr. Gross may be strongly urged: ℞ Antimonii et pot. tart., morphinæ sulphatis, āā gr. ij; magnesii sulphatis, ℥ ij; aquæ destil., ℥ x; syrupi zingiberis, ℥ ij; acidi sulph. aromatici, ʒ ss.; tinct. veratri viridis, ʒ jss. M. Dose, tablespoonful every two, three, four, or six hours. "Should this mixture produce emesis or severe nausea, the dose must be diminished

Colchicum may be added when there is a rheumatic or gouty state of the system, quinine when there is a tendency to periodicity, and copaiba when there is renal or cystic trouble. The quantity of morphine may be increased when there is much pain." An efficient antiphlogistic is a combination of tartar emetic, sulphate of morphine, and sodii et potassii tartras, in a solution of syrup and water. To relieve pain and promote diaphoresis in rheumatic and catarrhal inflammations, few agents are more effective than Dover's powders in full doses, gr. xv to xx, every night, or every eight or twelve hours. The so-called syrupus Doveri (Gregory's) is an admirable preparation, and may be given in doses of ʒ j to iij, either alone or in combination with other suitable agents, such as the cardiac and nerve sedatives, and sulphate of quinine. In low forms of inflammation, attended with loss of sleep, nervous excitement, and reflex irritability, the bromide of potassium, in full doses, is often called for. If violent pain is present, sulphate of morphine should be added: ℞ Morphinæ sulphatis, gr. ij; potassii bromidi, ʒ iv; syrupi aurantii, ℥ ij. M. Dose, teaspoonful in water every two hours until relieved. There are few cases of acute inflammations in which, sooner or later, *tonics* do not prove indispensable. Of these agents, quinine and tinct. ferri chloridi, with brandy, whisky, or wine, are by far the most valuable.

Chronic Inflammation.—In the *local* treatment of this condition a primary object is to check exudation and cell migration—that is, to bring the vascular wall into a healthy state. For this purpose the metallic and vegetable astringents are most useful. But it may, with the same object, be well to draw more blood into the part, in order that the vascular wall may be the better nourished. This is effected by *stimulants*, which are of well-known efficacy in chronic inflammation. These agents are for the most part the same as astringents, but are used in a more concentrated form. For this effect the nitrate of silver, sulphate of copper, and certain resins and balsams are frequently employed. Again, it is sometimes better to sweep the old tissues away and allow new vessels to be formed, which will probably have healthier walls. This is effected by destructive *caustics* (escharotics), as pure nitrate of silver, potassa fusa, chloride of zinc, or even the actual cautery. It is in chronic inflammation that the so-called "counter-irritants," which set up a rival inflammation, are of most service. In order to relieve an inflammation, for instance, of the knee-joint, we produce a superficial inflammation of the skin. There is undoubted efficacy in this treatment, but whether the action is transmitted through the nerves, or by withdrawing the blood, or by stimulation of the lymphatic, is not fully known. The substances used for *counter-irritation* are either vesicants, such as cantharides or ammonia; or rubefacients, as mustard, turpentine, or iodine. Dry heat at different temperatures may produce the effect of either of these classes. When redness is produced on the skin, it does not follow that hyperæmia alone results. In fact, the desquamation often shows that a low form of inflammation has been established.

In the *constitutional* treatment of chronic inflammation, hygienic measures are first in importance. Pure air, sunlight, digestible, nourishing diet, and cleanliness are indispensable. "It is in cachectic persons, or persons with an inherited proclivity (perhaps not yet manifest) to cachectic diseases, that inflammations most tend to become chronic. Hence, the first rule is to improve nutrition. Many patients with chronic inflammations get well at once when placed in good quarters and on good food." Next in importance are nutrient tonics, the chief of which is *cod-liver oil*. There are few chronic inflammations that it does not benefit. *Iron* is frequently of great value; and if it fail, or is contra-indicated, *arsenic* may be employed. In chronic inflammation of fibrous tissues, *iodide of potassium* is of unequaled efficiency. Other inflammations, either acute or chronic, are benefited by mercury, colchicum, salicylate of sodium, and other agents according to the nature of the disease with which they are associated, and in their action tend to remove cause of the particular disease, rather than to antagonize the inflammatory process.

Syphilis.—The treatment of this affection is local and constitutional. If, as a result of contagion or suspicious connection, the virile organ has upon it a papule, pustule, abrasion, or sore which may be the forerunner of constitutional infection, a "*caustic*" application should be made at once to prevent, if possible, absorption of contagious material as well as to destroy the morbid structure, and to create a healthy recuperative action in the part. The best agent for this purpose consists in the topical application of a drop of *nitric acid*, or the *acid nitrate of mercury*, by means of a small pointed stick or the end of a glass rod. Cold-water dressing may be used afterward, and, at the end of two or three days, when the slough has separated, the following lotion: ℞ Ferri et pot. tartratis, ℈j; aquæ, ℥iv. M. To be applied on lint. In case of much suppuration, the surface of the venereal sore should be cleaned, dried, and dressed with finely *powdered iodoform*. The patient should be placed at once upon constitutional treatment: ℞ Hydrargyri chloridi corrosivi, ammonii chloridi, āā grs. iij; aquæ, tr. cinch. comp., āā ℥iij. M. Dose, teaspoonful morning and evening for one week; after this, thrice daily. When the medicine has been taken about two weeks, it should be omitted a few days, and then resumed as before. Mercury in some form should be given more or less constantly for at least a year after contagion. But during this period it will become necessary to omit this agent from time to time, and never to push it to the extent of inducing ptyalism. The form of the drug is also varied according to the peculiar circumstances of each case. In the latter part of the secondary stage, iodine may be used with mercury. The improved "yellow" or protiodide of mercury (hydrargyri iodidum viride), prepared by McKesson & Robbins, of New York, in doses of gr. 1/8 to 1/4, appears to be well borne by the stomach, and very efficient. It is given in the form of pill most conveniently. At this time the liquor hydrarg. et arsenici iodidi is of great utility: ℞ Solutio. Donovani, ʒij–iv; elix. simp., ℥iij. M. Dose, teaspoonful after meals. In anæmic states, in any stage of the malady, iron should be combined with the mercury. In the late forms of the disease the following is much employed: ℞ Hydrarg. chloridi corrosivi, grs. ij; potassii iodidi, ʒij; spts. ammonii aromatici, tr. cinch. comp., syrupi sarsaparillæ co., āā ℥ij. M. Dose, teaspoonful in water thrice daily after meals.

Scrofula.—The treatment of this affection is preventive and curative, having reference to the strumous disposition as well as the dependent structural lesions. Its cure is to be sought in carrying out the rules of health; fresh air and sunlight are especially needful. "Iodine, once thought to be a specific, has much sunk in repute; cod-liver oil ought, perhaps, to be reckoned a food, although it possesses alterative constituents. The cure of the local lesions not only relates to the sundry lesions themselves, but is also a means of preventing further development of the disease. Cure and prevention thus go hand in hand. With regard to the glandular abscesses and phlegmonous scrofulides—the chief sources of general tubercular infection—it would seem to be more reasonable to favor the outward discharge of the matter than to strive to promote its absorption. Scrofulous bones have been removed with the same intention. In order to improve the general nutrition, wine, beer, or distilled spirits have an excellent effect. Many emaciated, scrofulous patients rapidly become fat under the use of small quantities of whisky taken frequently during the day." Arsenic, as an aid to nutrition, well deserves a high place among the internal remedies for scrofula. Donovan's solution is an appropriate form. Ferri iodidum in the form of the officinal syrup, given after meals, is a powerful remedy in all forms of scrofula. The diluted phosphoric acid, in doses of ♏v–xx, with some vegetable bitter, thrice daily, is also to be strongly recommended. "Cod-liver oil is of great benefit to the pale or emaciated subjects of the scrofulous or tuberculous diathesis; but scrofulous glandular enlargements are generally but slightly influenced by this remedy. After, however, suppuration has taken place, the action of the oil is more manifest. Discharges from scrofulous abscesses often speedily disappear under its use. In scrofulous diseases of the skin, joints,

bones, as well as in scrofulous ozæna, otorrhœa, and ophthalmia, it is productive of excellent results, especially when persevered with and accompanied by good hygienic treatment." Of dietetic and hygienic measures, the "*grape cure*," *malt extract*, sea air and bathing, and the use of various mineral-waters, are worthy of a prominent position in the management of this obstinate affection.

Tuberculosis.—The acute form of this disease, if arrested at all, requires immediate and active treatment. "The patient should be fed every two hours with milk-soup or other light nourishment, and from four to six ounces of whisky should be taken through the day." The night-sweats may be controlled by atropine or picrotoxin at bed-time. The temperature may be lowered by towels dipped in cold water and applied over the chest and abdomen or head for half an hour, and repeated from time to time. Should the febrile symptoms continue unabated, the following might be tried: ℞ Quininæ sulphatis, ℈ij; tr. digitalis, tr. opii, acid phosph. dil., āā ʒij; aquæ, syrup. aurantii, āā ℥ij. M. Dose, tablespoonful every four or six hours until the temperature is lowered.

Chronic Tuberculosis.—Regarding chronic phthisis, as well as the acute form, as essentially a disease of *malnutrition*, every means that can be devised should be employed to increase the appetite and the assimilation of nutriment, *and, unless this can be accomplished, all cases are hopeless.* "The most important hygienic measures are to change from in-door sedentary habits to out-door active ones. The appetite and taste of the patient should suggest the food, and also the use of alcoholic stimulants. *Cod-liver oil* benefits about a fourth of the cases; the *hypophosphites* about the same. *Alcoholic stimulants* check the disease more or less in a third of the cases. *Pancreatic emulsion* is useful when the dejections contain floating fat." To invigorate the system and promote the appetite, the use of the astringent preparations of iron are demanded. Tr. ferri chloridi, with small doses of quinine, strychnine, or the vegetable bitters, will prove most successful. Arsenic is also one of the best agents for this purpose: ℞ Liq. potassii arsenitis, ʒij; vini ferri amari, ℥iij. M. Dose, teaspoonful after meals. Counter-irritation of the chest may be effected by the use of croton-oil, tr. iodine, or with the emplas. picis Burgundicæ. The cough, when troublesome, may be relieved by ℞ Syrup. prun. Virg., syrup. lactucarii, āā ℥ij. M. Dose, dessertspoonful at bed-time, or through the day if required. If the disease follows an attack of pneumonia, the following may be tried: ℞ Potassii iodidi, ammonii iodidi, āā ʒij; syrup tolu, ℥iij. M. Dose, teaspoonful two hours after meals. To palliate the cough, the following is efficient: ℞ Morphinæ sulph., grs. iij; syrup tolu, syrup. prun. Virg., āā ℥jss. M. Dose, teaspoonful two or three times a day. If there be night-sweats, sulphate of atropine, gr. 1/60, should be added to each dose. Diarrhœa may be controlled by pills of argenti nitras and opium, given between meals, or by the following formula: ℞ Ext. eucalypti fluid, ℥ss.; bismuth subnitrat., ʒij; mucilag. acaciæ, syrup. aurantii, āā ℥ij. M. Dose, tablespoonful after each operation until relieved.

III. Diseases of the Circulatory System.

Angina Pectoris.—To prevent and render less severe the paroxysms of this disease, iron, strychnine, and arsenic, in small doses, should be administered daily. During a paroxysm mustard draughts or turpentine stupes should be applied between the shoulders and over the chest, while the patient's feet are placed in a hot foot-bath. Stimulants and anodynes are also indicated, as: ℞ Tr. digitalis, tr. belladonnæ, tr. valerianæ, spts. etheris comp., āā ʒj. M. Dose, ten to twenty drops during the access of pain; and if the attack prolongs itself, a hypodermic injection of morphine and atropine is demanded. To relieve the paroxysm, amyl nitrite has been highly praised. About two or three drops by inhalation usually afford relief. Fatty degeneration of the heart contra-indicates its use. The same is true of chloroform.

Cardiac Dilatation.—The indications are to maintain nutrition and to

avoid violent cardiac action. ℞ Ext. digitalis, grs. v; ext. belladonnæ, gr. j; ferri reducti, ℈ij. M. Ft. Pil. No. XX. Dose, one after meals. Belladonna is one of the best agents that can be employed to overcome irregularity of cardiac action, and to relieve pain. ℞ Emplas. belladonnæ, 4 × 6 inches. To be worn over cardiac region. Dry cups to the chest are useful to relieve pulmonary congestion. When dropsy occurs in cases of cardiac dilatation, the diuretics which give most relief after digitalis are the acetate, bitartrate, and the iodide of potassium, nitrous ether, the infusion and compound spirits of juniper or gin. Hydragogue cathartics, such as pulv. jalap. comp., or the following formula, may be employed to aid in subduing the dropsical effusion: ℞ Elaterii, gr. j; pulv. capsici, grs. vj; ext. hyoscyami, grs. xij. M. Ft. Pil. No. XII. Dose, one every six hours until relief is obtained.

Cardiac Hypertrophy.—If cardiac dilatation and hypertrophy co-exist, the main principle is to avoid exciting causes, especially violent exercise, alcoholic stimulants, and venery. "Moderate venesection, at long intervals, is appropriate for robust patients; occasional leeching, or cupping over the heart, may be resorted to." As an astringent and cardiac sedative, acetate of lead is worthy of a trial. ℞ Plumbi acetatis, ʒ ss.; pulv. opii, grs. v; confectio. rosæ, q. s. M. Ft. Pil. No. XX. Dose, one thrice daily. Fluid extract of wild cherry, in doses of ʒ ss.-j, may also prove of benefit. "A certain amount of hypertrophy with valvular disease is beneficial, and judgment must be exercised in order to determine when to interfere and when to not." As a cardiac sedative for persistent use, the following is suggested: ℞ Tr. aconiti, ʒ ss.; tr. veratri viridis, ʒ jss.; tr. zingiberis, ʒ vss. M. Dose, fifteen drops two hours after meals. The tincture of ginger causes the veratrum viride to be better borne by the stomach. In a large number of cases this formula prevents the further growth of the heart, and in some cases is said to lessen the already existing bulk of the organ. Potassii iodidum, in small doses, *long continued*, seems to exercise in some cases a beneficial influence.

Rheumatic Carditis.—When this condition is developed, the patient should be kept in bed. Opium, in small doses, should be given. The chest should be covered with flannel, and not exposed. If the heart becomes feeble, digitalis is indicated. Colchicum, with alkalies, should be given to eliminate the "materies morbi." Mercurials to the extent of slight ptyalism in young, robust patients, is strongly advocated. The application of from three to twelve leeches to the cardiac region is also strongly advised. The following formula is likely to be of great benefit: ℞ Tr. veratri viridis, tr. opii, āā ʒ j; sodii bicarb., ʒ ij; sacchari albi, ʒ iv; aquæ, q. s. ad ℥ vj. M. Dose, tablespoonful every two or three hours. For children, the quantity of opium should be reduced one half, and the doses graduated according to their ages. In the early stages of *pericarditis*, to relieve pain, distress, and inflammatory action, turpentine stupes may be employed. In the advanced stages, when effusion has taken place, of all local remedies blisters are of the greatest service, being of the most conspicuous value when the amount of fluid is greatest.

Functional Cardiac Palpitation.—In this affection the following prescription may be employed: ℞ Tr. digitalis, ʒ ij; potassii bromidi, ʒ iv; elix. simp., ℥ iij. M. Dose, teaspoonful thrice daily. The *potassio-tartrate of iron* should be added to this prescription when anæmia is present. A belladonna plaster should be worn over the heart. Digitalis, with the bitter wine of iron, may often be used to advantage during the intervals of attack. When the attacks of palpitation are violent, Hoffmann's anodyne, and rest in the recumbent position, are often requisite. The promptest relief of pain is by hypodermic injections of morphine and atropine.

Cardiac Valvular Disease.—All valvular diseases require rest, the avoidance of strong emotions, a nutritious diet, and temperance. If anæmia is present, iron is called for. ℞ Ext. digitalis, grs. x; ferri reducti, quininæ sulphatis, āā ℈j. M. Ft. Pil. No. X. Dose, one, two or three times a day.

In the anasarca from valvular disease, the following may be employed: ℞ Tr. digitalis, ʒ ij; vini colchici, ʒ j; potassii iodidi, ʒ ij; syrup. sarsap., aquæ, āā ℥ jss. M. Dose, teaspoonful three or four times a day. The patient should be purged every third day with the compound jalap powder. In *mitral regurgitation* morphine may be used subcutaneously at bed-time, keeping the patient quiet afterward. Its use is contra-indicated by the presence of albumen in the urine.

Aneurism.—There are but two or three remedies of much utility in the treatment of internal aneurism. The first is *iodide of potassium.* It should be used boldly and persistently. ℞ Potassii iodidi, ʒ vj; aquæ, syrup. tolu, āā ℥ iij. M. Dose, dessertspoonful thrice daily. "This remedy does no good except early in the disease." Excellent results are also obtained from *ergot.* The patient should be restricted in diet, and the recumbent position maintained as much as possible. Digitalis has been suggested, and even highly praised, by some authorities; but it is a remedy of doubtful expediency. "It may act as a 'spur' to the natural efforts to rupture the sack." Aconite, veratrum, and chloralhydrate may be used to lower the blood-pressure. Anodynes may be given to relieve pain and restlessness, and to overcome wakefulness. Pills of ext. lactucarii may be taken at bed-time. The application of *belladonna plasters* often gives relief.

IV. Diseases of the Respiratory System.

Tonsillitis.—This affection really is but the local manifestation of a general disease, and is, in fact, an essential fever. Its incipient stage requires the use of cholagogue or saline purgatives, and large doses of quinine once or twice a day to control the temperature. Tr. aconiti, tr. veratri viridis, or tartar emetic, in minute doses, frequently repeated, are of great utility. Scarification of the tonsils, leeches between the angle of the jaw and sterno-cleido-mastoid muscle, and blisters to the nape of the neck, will be found of the greatest service. The external and internal use of turpentine is strongly recommended. ℞ Ol. terebinth., ʒ ij; pulv. acaciæ, sacch. albi, āā ʒ iv; aquæ, ℥ v; pulv. potassii chloratis, ʒ ij. M. Shake well, and take a tablespoonful every hour or two until the inflammatory symptoms begin to subside, and then less often. The topical effects are best secured by rinsing the mouth and throat before taking. One of the most efficient gargles is as follows: ℞ Ext. rhois glabræ fluid, potassii chloratis, āā ℥ ss.; aquæ (fervens.), Oj. M. Use as often as convenient. To relieve the pain and inflammatory condition of the tonsils, the application of "listerine" is very efficient. It should be used by means of the hand-ball spray apparatus. As soon as an abscess forms, it should be opened cautiously with a sharp-pointed bistoury, the cutting edge being directed toward the mesial line.

Asthma.—Many drugs are more or less beneficial in this affection; but what succeeds admirably in one case may fail completely in another, and the physician, when possible, should direct the treatment to the cause. As asthma is a neurosal affection, prompt relief is often obtained by the application of counter-irritation over the pneumogastric nerve along each side of the neck, in front of the sterno-cleido-mastoid muscle, from the mastoid process to the clavicle. Strong tincture of iodine (Churchhill's), or cantharidal collodion, may be used for this purpose. During the paroxysm all nauseants have a certain influence in relaxing the bronchial spasms. ℞ Tr. lobeliæ, tr. hyoscyami, spts. ætheris comp., syrup. tolu, āā ℥ j. M. Dose, teaspoonful every half hour during the attack, until some effect upon the breathing is manifest, and then every hour or two until decided relief. Another formula of considerable value is: ℞ Tr. veratri viridis, ♏xxiv; morphinæ sulphatis, gr. j; syrupi ipecac, ℥ j. M. Dose, teaspoonful every three hours if necessary. "Frequently ext. grindelia robusta fluid is very [ef]ficient. Dose, one teaspoonful when the paroxysm begins, and half the [qua]ntity three times a day as a prophylactic." But the promptest relief is [gene]rally obtained by the subcutaneous injection of *morphine and atropine.*

If the asthma is complicated with emphysema and chronic bronchitis, the following is efficient: ℞ Potassii iodidi, ʒ ij; morphinæ sulph., gr. j; tr. scillæ, tr. lobeliæ, syrup. aurantii, āā ℥ j. M. Dose, teaspoonful thrice daily. During the intervals of attack, the following will be found of great benefit: ℞ Tr. belladonnæ, ʒ j; potassii iodidi, ʒ ij; liq. potassii arsenitis, ʒ iij; spts. ammoniæ aromatic., ℥ j; elix. simplicis, ℥ jss. M. Dose, teaspoonful in water after regular meals.

Acute Bronchitis.—The treatment of this affection is hygienic, local, and medicinal. The first requires an equable temperature (about 65°), moist atmosphere, hot foot-baths, and a restricted diet. Local measures consist of the application of mustard draughts, turpentine stupes, volatile liniment or dry-cupping to the chest, and inhalation of steam, simple or medicated. The medicinal treatment requires first the use of nauseating and afterward stimulating expectorants. Bronchitis in its incipient stage can generally be cut short by means of a full dose of quinine and morphine, or the following: ℞ Vini antimonii, glycerini, syrup. tolu, āā ℥ j. M. Dose, teaspoonful every hour until nausea is induced. The tincture of veratrum viride or aconite, the syrup of ipecac, simple and compound, and the compound syrup of squills, are among the most useful agents in the early stages. The following combination is also suggested: ℞ Tr. veratri viridis, ʒ j; ammonii chloridi, ʒ ij; syrup. pruni Virg., ʒ vij; mistura glycyrrh. co., ℥ iij. M. Dose, teaspoonful in water every three or four hours. After free secretion is established, the following will be found a useful stimulating expectorant and antispasmodic: ℞ Ammonii carbonatis, ʒ j; spts. chloroformi, ℥ j; syrup. acaciæ, aquæ, āā ℥ ijss. M. Dose, tablespoonful thrice daily.

Chronic Bronchitis.—In the protracted bronchitic affections of the aged, remedies which tend to invigorate the general system are indicated; "but, as the disease generally depends upon organic changes, a cure can hardly be expected." "The so-called expectorants are useless except during the acute exacerbations. Sedatives may be called for when the cough is very harassing; but a certain amount of cough is desirable to rid the lungs of mucus." Ammonii chloridum is a most valuable remedy. The following are useful formulæ: ℞ Ammonii chloridi, ʒ ij; ol. eucalypti, ʒ ij; elix. glycyrrh., syrup. tolu, āā ℥ iij. M. Dose, tablespoonful every four or six hours. ℞ Ammonii carbonatis, gr. xxxij; ext. senegæ fluid, ext. scillæ fluid, āā ʒ j; tr. opii camph., ʒ vj; syrup. acaciæ, syrup. tolu, āā ℥ jss. M. Dose, teaspoonful every three or four hours. ℞ Liquor potassii, ʒ ij; copaibæ, ℥ j; syrup. acaciæ, elix. glycyrrh., āā ℥ jss. M. Dose, teaspoonful every four or six hours. In bronchitis with asthma and emphysema, the following should be employed: ℞ Potassii iodidi, ʒ ij; tr. belladonnæ, ʒ ij; spts. ætheris comp., ℥ j; syrup. pruni Virg., ℥ iij. M. Dose, teaspoonful thrice daily. In the bronchial cough of phthisis, the following is most useful: ℞ Atropinæ sulphatis, gr. j; morphinæ sulph., gr. iv; ol. eucalypti, glycerini, āā ℥ ss.; syrup. pruni Virg., syrup. tolu, āā ℥ iijss. M. Dose, teaspoonful every four or six hours and at bed-time.

Hæmoptysis.—In case of pulmonary hæmorrhage, the first duty of the physician is to calm the mental agitation of the patient. "The room should be kept cool, hot drinks forbidden, and all food eaten cold. Conversation should be prohibited and the patient urged to resist the provocation to cough." Ice-cold applications to the spine, chest, or over the heart, is a measure of doubtful expediency, though they sometimes *instantaneously arrest the hæmorrhage.* The extremities should be placed in hot water. Ergotine may be used hypodermically, or the fluid extracts of ergot and of hamamelis, equal parts, may be given in teaspoonful doses. The following combination is efficient: ℞ Ext. ipecac. fluid, ext. digitalis fluid, āā ʒ ij; ext. ergot fluid, ʒ iv. M. Dose, thirty minims to a teaspoonful as required. There are few more powerful astringents in pulmonary hæmorrhage than spts. of turpentine: ℞ Ol. terebinth., ʒ ij; tr. verat. virid., ♏ xx; syrup simplicis, ℥ ij. M. Dose, tablespoonful at once, and repeat in diminished doses every two, three, or four hours, according to the urgency of the hæmorrh

vegetables, other than those containing much sugar and starch. The sub-acid fruits are admissible. "But all saccharine, and especially farinaceous, articles of diet are detrimental." Perhaps the best diet is that of skimmed milk exclusively. Of this the patient may drink *ad libitum*. "The alkalies and alkaline waters have proved among the best remedies in diabetes mellitus. The natural waters—such as Carlsbad in Europe; in the United States, Bedford Springs, Virginia; Congress Springs, New York, and the Bethesda water from Waukesha, Wisconsin—are of most value." The latter has, however, a wider and a more deserved reputation in *Bright's disease*, and its use should not be neglected. Of medicines, calcii sulphide, gr. 1/6; codeine, gr. 1/6; potassii bromidum, gr. xv–xx; sodii salicylas, ʒ ss., thrice daily, are entitled to most credit. They may each be tried in succession. The dose of codeine may be gradually increased to gr. ij thrice a day. The following is a useful combination: ℞ Morphinæ sulphatis, gr. iij; acidi gallici, ʒ ij; acid. phosph. dil., ℥ ss.; ext. ergot, fluid, ℥ ijss. M. Dose, one to two teaspoonfuls in water three or four times a day.

Dropsy.—In a pathological sense, dropsy is not a disease, but a symptom directly dependent either on inflammation, mechanical obstruction, malnutrition of blood-vessels, or altered composition of the blood. Its rational treatment must, therefore, be guided by an appreciation of those causative changes. The best means of promoting diaphoresis is by means of the hot-air or Turkish bath, or by the use of jaborandi. The best purgatives are elaterium or the compound jalap powder. The following pills act as a diuretic or cathartic: ℞ Trituratio. elaterii, ext. digitalis, ext. scillæ, ext. hyoscyami, āā gr. xx. M. Ft. Pil. No. XX. Dose, one pill every other night. Small doses of mercury often aid the action of diuretics: ℞ Trituratio. elaterii, ext. digitalis, ext. scillæ, pulv. capsici, pil. hydrargyri, āā gr. xx. M. Ft. Pil. No. XX. Dose, one pill one to three times daily. ℞ Potassii acetatis, ʒ iij; spts. ætheris nitrosi, ʒ v; decocti scoparii, Oj. M. Dose, wineglassful alternately with above pills. At the same time apply equal parts of unguentum hydrargyri and belladonnæ over the abdomen. Of other diuretics, the fluid extract of asclepias Syriaca, in doses of ♏x, either in gin or infusion of juniper, is worthy of special mention. If there is not too much irritation of the kidneys, an ounce of potassii bitartras may be added to a pint of infusion of juniper, and of this a tablespoonful may be taken every two or three hours. A combination of tr. ferri chloridi and digitalis with spts. ætheris nitrosi is useful in the dropsy of scarlatina and with other forms attended by anæmia. Bashan's mixture is also very valuable in such conditions. Diuresis is sometimes induced by the external application of digitalis; thus, equal parts of tr. digitalis and linimentum saponis may be used as an embrocation, or else an ounce of the tincture, added to a warm flaxseed poultice, may be applied to the lumbar region. When there is any tendency to absorption in ascites, it will be greatly accelerated by tightly bandaging the abdomen with flannel.

Hæmaturia.—Bloody urine is a symptom of so many diseases, as well as local injuries, that its treatment can only be referred to in general terms. "In all cases, cold applications to the hypogastrium, rest in the recumbent posture, and elevation of the pelvis, while the room is kept cool, are important accessories." The most valued drugs are ergot, tinct. ferri chloridi, gallic acid, ipecac, hamamelis, digitalis, or plumbi acetas, given alone, or more or less combined, and with or without opium. When there is debility or relaxation, the following is a useful combination: ℞ Ol. terebinth., ʒ iij; ext. digitalis fluid, ʒ j; mucilago acaciæ, ℥ ss.; aqua menth. pip., ℥ j. M. Dose, teaspoonful every three hours until checked, and then thrice daily.

Lithiasis.—In the *oxalic* and *phosphatic* varieties of calculus, the mineral acids render important service. The nitric or the hydrochloric acids should be given for a length of time in small and repeated doses. Citric, benzoic, [illegible]d the diluted phosphoric acids have also been prescribed with advantage. [illegible] cases of *uric-acid* diathesis, or brick-dust deposit, the following may be [illegible]: ℞ Sodii boratis, ʒ ij; ext. uvæ ursi fluid, ℥ j; tr. opii deodorata, spts.

ætheris nitrosi, āā ℥ ss.; aquæ, ℥ iij. M. Dose, teaspoonful from three to six times daily." The ext. hydrangeæ fluid may be given, in teaspoonful doses, three times daily, and to each dose may be added from three to five grains of benzoate or citrate of lithium. A ready-prepared lithiated fluid extract of hydrangea is an eligible preparation. Other salts of lithium or potassium, especially the bromides, are useful.

Nephritis.—Incipient nephritis, or active renal congestion, generally admits of speedy relief by confining the patient in a bed and in a warm room of a temperature above 75° F., and applying a dozen dry or wet cups over the lumbar region. A free supply of diluent drinks should be allowed. One or two drastic purgatives may be administered. Moderate diaphoresis may be induced, but all stimulants should be carefully avoided. In *passive renal congestion*, which is generally associated with some cardiac disease, digitalis is the most serviceable remedial agent. Large, light flaxseed poultices or belladonna plasters to the lumbar region, large enemata of tepid water, and opiates (especially Dover's powder), not only afford present relief, but arrest the progress of the disease. In cases of *strangury*, the result of the absorption of cantharidine or turpentine, prompt relief is generally afforded by a rectal injection of starch and laudanum, a hot sitz-bath, and the administration of aqua camphoræ. A hypodermic injection of morphine (gr. ⅛) also confers speedy relief. Rectal suppositories of belladonna and morphine produce the same effect.

Irritable Bladder.—In vesicle irritability the urine should be examined, and, if found to vary from the normal condition, the treatment must be directed to remedy this. The following is very efficient when the affection is of gonorrhœal or of traumatic origin: ℞ Potassii bromidi, ʒ ij; potassii carbonatis, ʒ j; tinct. gelsemii, ʒ j; aquæ camph., ℥ iij. M. Teaspoonful every four or six hours.

Cystitis.—The treatment of this affection requires "rest in bed with elevation of pelvis," alkaline diuretics and anodynes to relieve pain and tenesmus. "The rectum should be kept empty by the daily use of an enema of hot water." ℞ Potassii chloratis, ʒ iv; infusi. uvæ ursi, Oj. M. Dose, tablespoonful every two or three hours. The citrate or acetate of potassium, sodii bicarb., or liquor potassæ, may also be given, with flaxseed tea or infusion of buchu. Most cases of dysuria and mild cystitis may be relieved by ℞ Spts. ætheris nitrosi, tr. opii camph., āā ℥ j. M. Dose, half a teaspoonful every hour. In chronic cases, the following should be employed: ℞ Copaibæ, ℥ j; morph. sulph., gr. ij; pulv. acaciæ, sacch. albi, āā ʒ ij; ol. gaultheria, ♏x; aquæ, q. s., ad ℥ vj. M. Dose, one or two teaspoonfuls three or four times a day. Eucalyptus is also efficient: ℞ Ext. eucalypti fluid, ℥ j; syrup. acaciæ, elix. potassii bromidi, āā ℥ iijss. M. Dose, dessertspoonful three or four times daily. "Chronic cystitis is usually owing to an inability of the bladder to empty its contents. In such cases a soft rubber catheter should be used twice daily. If the bladder is not emptied completely, it should be washed out with tepid water (about ℥ ij), which should be retained only for a minute or less time. Sometimes medicated injections are indicated." ℞ Sodii boratis, ℥ j; glycerini, aquæ, āā ℥ ij. M. Add two or three teaspoonfuls to ℥ iv of tepid water, and use ℥ j at a time, and repeat until the injection comes away clear. The point of the catheter should not be allowed to come in contact with the walls of the bladder. One of the most useful injections for cleansing the bladder of viscid mucus is sulph. of quinine in the proportion of gr. j to ℥ j. "It is especially useful in those forms of subacute cystitis, with mucopurulent discharge, that occur from any source of vesical irritation." A solution of permanganate of potassium of the same strength may be used for the same purpose.

Enuresis.—Children affected with incontinence of urine should be made to empty the bladder on going to bed, and two or three times during the night the patient should be taken up and again made to urinate. "Sleeping on the back should be prevented. The supine position is one which, of all others, increases the amount of blood in the cord, and hence augments its irritabilit[y]

The following prescription should be persistently given for at least three or four months; if stopped sooner, the affection is liable to return": ℞ Syrup. ferri bromidi, ℥ iv. Dose, half a teaspoonful in water after meals, and a like amount of fluid extract of ergot to be taken each night at bed-time. In strumous children, syrup. ferri iodidi may be given in place of the bromide of iron. When there is no evidence of anæmia and debility, and the disorder appears to depend upon an irritability of the bladder, belladonna in doses sufficient to produce its physiological effects cures a certain proportion of cases, but the tincture of gelsemium sometimes succeeds where belladonna fails.

Prostatic Hypertrophy.—"The catheter is the natural specific for enlarged prostate. No patient is safe unless he can pass a catheter himself. He should be instructed how to use it, and to draw off the residual urine twice a day. The bowels should be kept open by saline purgatives. Condiments and alcoholic stimulants must be renounced; also horse-back exercise and venery. Flannel should be worn next the skin, and exposure to cold avoided. Control over the bladder may be regained by means of ext. ergot fluid, ♏xv, three times a day. After restoration of vesical power, a single dose should be administered at bed-time." The tinct. of nux vomica, or strychnine, may be used for the same purpose. To diminish the hypertrophy, rectal suppositories containing *iodoform* or *potassii iodidum*, with ext. hyoscyami, should be used at bed-time. ℞ Potassii iodidi, ʒ ss.; ext. hyoscyami, ʒ j; olei theobromæ, ʒ vj. M. Ft. Suppositories No. XII. One every night.

VI. Diseases of the Nervous System.

Apoplexy.—The general treatment of apoplexy should be directed—*first*, to the prodromic stage of cerebral congestion; *secondly*, to the apoplectic seizure; *thirdly*, to its consequences. "To relieve cerebral hyperæmia, local bleeding, as cups to the nape of the neck or leeches to the temples, often affords marked relief. Cold is another very useful agent, as ice or cold water to the cranium and back of the neck. During sleep the head should be elevated. The clothing should be loose around the neck. Sinapisms to the feet and epigastrium are also of service, and hydragogue purgatives may be required." Internally, the bromides of potassium, sodium, calcium, or lithium may be indicated. Ergot contracts the cerebral vessels, and is of great value in the treatment of active cerebral congestion in all its forms. In the first or hyperæmic stage an excellent combination is: ℞ Sodii bromidi, ℥ j; ext. ergot. fluid, ℥ iv. M. Dose, teaspoonful three times a day. After symptoms of congestion have disappeared, it may be expedient to give tonics and restoratives. The following is well suited to such cases: ℞ Strychninæ sulphatis, gr. j; ferri pyrophosphatis, sodii pyrophosphatis, quininæ sulphatis, āā ʒ j; acid phosphoric. dil., syrup. zingiberis, āā ℥ ij. M. Dose, teaspoonful in water three times a day. "The bowels should be kept open, severe muscular exertion avoided. The stomach should not be overloaded. Alcoholic stimulants should be shunned and the mind maintained tranquil. During an *attack* of apoplexy, when coma and the ordinary symptoms of this condition are present, there is nothing to be done in the way of medication which can afford the slightest prospect of relief. Blood-letting, purgation, and the iodide of potassium do no good whatever, and the first two probably harm. The patient should be kept perfectly quiet with the head well elevated, and in a well-ventilated room, having a temperature of about 60° F. The bowels, if not moved naturally every day, may be emptied by an enema of warm water, and the urine should be drawn off with a catheter if required. The strength, as indicated by the pulse, should be kept up by the cautious use of stimulants; and, if the patient is restless and does not sleep well, some of the bromides may be administered, or chloralhydrate may be used by enema. The food should be of the most nutritious character and taken frequently." If symptoms of inflammation make their appearance, cold to the head and blisters to the nape of the neck are called for. In from three to

six weeks after the stroke it will be proper to resort to means for restoring the power of motion. "These measures consist of passive motion, strychnine, phosphorus, and electricity. The muscles of the affected limbs should be kneaded, the joints flexed and extended, and the surface rubbed every day for five to ten minutes at a time. Strychnine should be administered, preferably by hypodermic injection, in doses of gr. $1/_{32}$ once a day. In many old cases of hemiplegia this has an excellent effect." Internally, the commencing dose of Hall's solution should be ℳx twice or thrice daily, and increasing the dose one minim each day until its physiological effects are noted, provided the maximum dose does not exceed twenty minims. Phosphorus could be employed as follows: ℞ Zinci phosphidi, gr. iij; ext. nucis vomicæ, gr. x. M. Ft. Pil. No. XXX. Dose, one pill three times daily. "No agent, however, is as valuable as electricity." The poles of the battery, terminated by wet sponges, should be applied to the skin covering the muscles or to the nerves which supply them. The interrupted current should be employed. The same agent is valuable to restore sensibility to the parts. The treatment should last from ten to fifteen minutes, and repeated daily or thrice a week.

Vertigo.—The first and most important measure of treatment for this affection consists in the removal of the apparent causes. "But agencies of a depressing character are hurtful. On the contrary, tonic remedies, nutritious diet, and other hygienic means of invigorating the general health are useful. As a rule, the practitioner can assure those apprehensive of an attack of apoplexy of the absence of all danger. Vascular tonics, such as digitalis or moderate doses of ergot, are of benefit." In *gastric vertigo*, when all other means fail, the thorough adoption of *milk-diet* seldom fails of relief. "Aural vertigo demands points of cautery behind and in front of the ear alternately. Ocular vertigo requires appropriate glasses. Tobacco is a common cause of vertigo, and its use in all cases should be discontinued." "In the *vertigo of old persons*, which occurs sometimes paroxysmally as a single symptom, unassociated with any special state that can account for it, the following has been found very efficient: ℞ Hydrargyri bichloridi, gr. j; glycerini, ℥j; tinct. cinchonæ comp., ℥ij; ol. menth. pip., ℳxxiv. M. Dose, teaspoonful in a wineglass of water thrice daily."

Insomnia.—"The principles which govern the treatment of wakefulness are those which tend to soothe the nervous system, or to distract attention, diminish the action of the heart and blood-vessels, or correct irregularities in their function, and thus lessen the amount of blood in the brain. Often a *hearty supper* of plainly cooked and nutritious food predisposes to sleep by diverting the blood from the brain to the digestive organs. In the asthenic or passive form of insomnia, *stimulants* may be of service. *Physical exercise* in the open air, extended to the point of inducing a feeling of slight fatigue, is productive of good effects." The *warm bath* calms nervous irritability and diminishes hyperæmia of the brain. A hot foot-bath contributes to the same result. Insomnia dependent upon severe and long-continued mental exertion imperatively demands intervals of relaxation, and, in some cases, complete mental rest. Travel is always of the greatest advantage in such cases. Among the purely medicinal agents, chloralhydrate and the bromides of potassium or sodium hold the first rank. They diminish the amount of blood in the brain and tend to allay any excitement which may be present in the sthenic form of insomnia. Chloralhydrate is the surest hypnotic, but must be given with greater caution than with the bromides, not only from fear of contracting the chloral habit, but also in cases where there is dyspnœa, heart disease, great debility, or a hypochondriac tendency. Insomnia from pain is best relieved by the opium alkaloids. Codeine leaves the least *malaise* or disturbance of the system.

Headaches.—"Cephalalgia as a symptom is found associated with many varying conditions, as periostitis of the cranium, diseases of the teeth, ear, and eye, astigmatism, cerebral affections, neuralgia and rheumatism of the scalp, quininism, uræmia, alcoholic poisoning, etc. Beyond these cases, where t

treatment is strictly ætiological, there are a variety of idiopathic forms which require special treatment." In atonic dyspepsia, when the tongue is pale at the tip and edges and the system weakly, few combinations are more successful than the following: ℞ Argenti oxidi, pulv. capsici, āā gr. x; ext. gentianæ, ext. colocynth. comp., āā ℈ij. M. Ft. Pil. No. XX. Dose, one twice daily. In nervous and hysterical headaches, the following is efficient: ℞ Spts. chloroformi, spts. ætheris comp., tr. lavandulæ comp., tr. valerianæ, āā ʒj; aquæ camph., ℥ijss. M. Dose, tablespoonful every half-hour until relieved. Opium may be added if indicated. In this form the citrate of caffeine or the aromatic spirit of ammonia are also useful. In congestive forms of headache, ergot with some of the bromides is indicated. In bilious or sick headache, a brisk emetic of salt and water, or ipecac and ammonii carbonas, affords the quickest relief. They may be followed by small doses of mercurials or of podophyllin, and then a dose of Rochelle salts or Seidlitz-powder. The persistent use of sodii phosphas is also indicated as a prophylactic when attacks are of frequent occurrence. Neuralgic headaches, if periodical, call for the use of arsenic, strychnine, or quinine. Cannabis Indica or gelsemium are also occasionally useful.

Neuralgia.—This affection, especially if chronic, is apt to be associated with defective nutrition. "The diet should be rich in fats and oils. Preparations of iron are useful only where there is actual anæmia. The *nerve tonics* (quinine, arsenic, and zinc) are beneficial in some cases, and not in others. Sulphate of quinine is useful in malarial, and also in some cases of non-malarial, neuralgia, especially that affecting the ophthalmic branches of the fifth pair of nerves. It must be given during the intervals of pain and in full doses (grs. x–xx), and its action may be enhanced by the addition of morphine. Arsenic is useful, and more widely so than quinine, in both the above classes of neuralgia. The valerianate of zinc has also been employed with benefit. Constitutional remedies must be directed against a real or presumed depravation of the blood by some special poison: as iodide of potassium and corrosive sublimate against syphilitic neuralgia, colchicum against gouty neuralgia, and sodii salicylas and potassii iodidum against rheumatic neuralgia. Of narcotic stimulant remedies for neuralgia, morphine and atropine are the best. Ext. cannabis Indica, in doses of gr. ¼ to gr. ½, in the form of a pill, may be taken at bed-time." A pill combining the various narcotics (Brown-Séquard's) is sometimes used to advantage. In cases of dental or facial neuralgia, ext. gelsemii fluid, ♏ij–v, every three or four hours, is especially useful. Many cases of chronic neuralgia are benefited by Gross's neuralgia pill, or else the following may be employed: ℞ Strychninæ phosphatis, gr. j; quininæ phosphatis, ʒj; syrup. hypophosphiti cum ferro, spts. frumenti, āā Oj. M. Dose, tablespoonful three times daily. Of external remedies, *blisters*, sinapisms, anodyne, ointments, plasters, and liniments, are of frequent and general use. For superficial neuralgia, the following is an excellent local application: ℞ Atropinæ sulph., gr. j; morphinæ sulphas, grs. xxiv; chloroformi ℥j; chloral camphor, ℥iij. M. Apply over region of pain with a camel's-hair brush. Internally, this combination may be given in capsules, or on a lump of sugar. As an anodyne, the dose is ♏x–xxx. "Whenever pain or convulsive nervous action is to be allayed, few combinations are considered of more general usefulness."

Chorea.—In this affection the indications of cure are, "first, to remove, if possible, all morbid states of the body which may tend to aggravate the disease, such as constipation, anæmia, amenorrhœa, worms; second, by well-regulated purgative medicines to subdue any cerebral congestion; and, third, to sustain the strength and improve the vigor of the nervous system by tonic and stimulant medicines, by food, and by cold baths." Chloralhydrate should be given at bed-time to secure sleep, and through the day the following may be taken: ℞ Zinci bromidi, ʒj; syrup. simplicis, ℥j. M. Dose, n drops in water thrice daily. If the patient is anæmic, the syrup of bro- of iron should be taken after meals. Liq. potassii arsenitis is also of value. It should be taken after meals in doses of ♏iij–v, and gradu-

ally increased until its physiological effects are induced. In the more chronic cases, strychnine is of great value. If the disease is associated with rheumatism, the following may be tried: ℞ Liq. potassii arsenitis, ʒ ss.; potassii iodidi, sodii salicylatis, āā ʒ j; syrup. simp., aquæ camphoræ, āā ℥ iij. M. Dose, tablespoonful thrice daily.

Hysteria.—During a paroxysm of this disorder, everything tight about the patient's person should be loosened, plenty of fresh air allowed, and the recumbent position maintained. To moderate the violence of the symptoms, ether or chloroform may be inhaled, or else morphine and atropine should be used hypodermically. The ammoniated tincture of valerian is a valuable remedy if the patient will swallow. Otherwise, shower-baths may be indicated, or else towels dipped in cold water should be applied to the hypogastrium and vulvæ. Ipecac or "tartar-emetic," in nauseating doses, often serves a useful purpose. They may be combined with cathartics if constipation exists. In short, the therapeutic indications, speaking generally, "are to blunt the sensitiveness of the nervous system by sedatives and anti-spasmodics during the paroxysms, and then to strengthen it by metallic and other tonics, and by hygiene. An attempt should also be made to cure all diseases of the sexual organs, and save the nervous system from visceral irritation, by good hygiene at menstrual periods; or by marriage, when the sexual organs crave their legitimate satisfaction."

Epilepsy.—The hygienic treatment of this disease is important. Moderate exercise in the open air, nutritious and easily digested food, but a restricted use of that which is nitrogenous, should be insisted upon. "Causes of excentric irritation—as intestinal worms, disordered menstruation, and local irritations—must be removed. The best-known medicinal treatment of idiopathic epilepsy consists in the simultaneous use of some tonic remedy (such as strychnine or arsenic) in solution, to be taken after meals, and of a mixture (Brown-Séquard's) of the bromides composed more or less like the following: ℞ Potassii bicarbonatis, ʒ j; potassii iodidi, ʒ ij; ammonii bromidi, ʒ iij; potassii bromidi, ℥ j; tr. calumbæ, ℥ j; aquæ destil., ℥ vj. M. Dose, one teaspoonful before each meal, and three teaspoonfuls at bed-time, in as much water as desired. According to many circumstances, the doses of one or another of the ingredients are to be changed. For example, if the '*petit mal*' exists alone or co-exists with the complete epilepsy, the dose of the bromide of ammonium must be increased and that of the other bromides diminished. If there is a weak pulse, the carbonate of ammonium is to be substituted for the bicarbonate of potassium. This mixture is to be taken persistently and for an indefinite time." The *bromide of zinc* is also an efficient agent. Hammond's formula is: ℞ Zinci bromidi, ʒ j; syrup. simp., ℥ j. M. Dose, ten drops, largely diluted with water, three times a day, and gradually increased to thirty. During the paroxysms, chloroform inhalations are of value, especially when they partake of a hysterical character with frequent recurrence. The severity and frequency of the convulsions may be diminished by the hypodermic use of morphine and atropine in combination; also by the following: ℞ Morphinæ sulphatis, gr. ij; tinct. veratri viridis, aquæ destil., āā ℥ ss. M. Use ♏xx during or before a convulsion. "The introduction of a *seton* (made of fifteen or twenty strands of silk or flax-thread) in the back of the neck is of great utility, and in obstinate chronic cases should be employed. It may be allowed to remain for months, if necessary, removing it only when the patient appears to be permanently improved. If it causes too much irritation it may be temporarily removed. The disturbance of the mental faculties, which is the common attendant in such cases, rapidly improves after the insertion of the seton."

VII. Diseases of Children.

Acute Bronchitis.—At the outset of this affection it is often of great importance to exhibit small and repeated doses of the tinct. of veratrum virid‹ In the first stage of the disease the following is suitable for a child five y‹

of age: ℞ Tr. verat. viridis, ♏viij; syrup. scillæ comp., ʒij; syrup tolu, ʒxiv. M. Dose, teaspoonful every two or three hours. When the pulse lowers, the temperature falls, and moisture appears upon the skin, the medicine is to be omitted. In this stage, equal parts of syrup ipecac and olive- or castor-oil, given in teaspoonful doses every three or four hours, is an effectual plan of treatment. The later or subacute stage of bronchitis requires the use of chlorate of potassium, ammonii chloridum, with other stimulating expectorants. In chronic laryngitis, following acute bronchitis, tr. of iodine may be applied over the larynx. In most cases the following will prove beneficial: ℞ Ext. cubebæ fluid, ʒj; syrup. simp., ℥iij. M. Dose, teaspoonful three or four times a day. For a child a year old, affected with bronchitis of two or three weeks' duration, the following would be suitable: ℞ Ammonii carb., gr. xvi; spts. ætheris comp., ʒjss.; syrup tolu, aquæ, āā ℥j. M. Dose, teaspoonful every two or three hours until relief, and then at longer intervals. In a similar case the following might likewise prove of service: ℞ Ammonii chloridi, ʒj; elix. glycyrrh., mucilag., acaciæ, aquæ, āā ℥j. M. Dose, half to one teaspoonful every three hours. The patient should be warmly clad, and every effort made to guard against taking cold.

Cholera Infantum.—In this disease prompt measures are required, as collapse is rapidly induced by the frequent watery discharges. To arrest the vomiting, and to restore the natural character of the discharges, minute doses of calomel may be given: ℞ Hydrargyri chlorid. mitis, gr. j; sodii bicarb., gr. vj. M. Ft. Chart. No. VI. Dose, one on a teaspoonful of water every hour. Should this be slow in its action, or there be indigestible material in the evacuations, a teaspoonful of equal parts of castor-oil and syrup of ipecac may be given to aid the discharges to carry off the intestinal contents. To check the discharges, minute doses of opium are often required: ℞ Tr. opii, gtt. iv; misturæ cretæ, ℥ij. M. Teaspoonful every two or three hours for an infant one year old. To assist digestion and restrain the bowels, the following is often indicated: ℞ Bismuth. subnitratis, pepsinæ saccharati, āā ʒj. M. Ft. Chart. No. XII. Dose, one powder every four hours after feeding. To relieve nausea and vomiting, creasote is often required: ℞ Creasoti, gtt. j; aquæ calcis, ℥ij. M. Dose, teaspoonful with an equal amount of milk *pro re nata.* "If there is much fever, the temperature and thirst must be reduced by cold sponging, after which quininæ sulph., gr. ss.–j, may be given every two or three hours during the intervals of the fever *until its effects are seen.*" After the acute stages of the disease are past, the oxide of zinc, in doses of gr. j–ij, may be given every four hours until the operations are reduced to two or three discharges daily. If the child be artificially fed, milk and lime-water, in the proportion of one to five, should be given. All farinaceous food should be avoided. The child should be nursed or fed at regular intervals, and not allowed too much at a time.

Convulsions.—During an attack, if the temperature is high, the child should be placed in a tepid-bath, gradually cooled down to 80° F., unless the body-heat is previously reduced to 100° F.; but if the child's temperature is below 100° F., then the warm-bath with mustard, and not the cold, should be employed. When the attacks run into each other, or recur at short intervals, revulsives should be applied to the spine and extremities, and compresses of cold water to the head. If there is much or persistent fever, veratrum viride and potassii bromidum should be given as follows: ℞ Tr. veratri viridis, gtt. xvj; potassii bromidi, ʒss.; syrup. aurantii, ℥ij. M. Dose, teaspoonful every hour or two (for a child one or two years old) until the fever and nervous agitation are abated. In similar cases, chloralhydrate, gr. ij, in syrup of orange, every two hours, may be given until symptoms are relieved. If the child will not swallow, twice this quantity could be given by enema with starch-water. Of course, other morbid associations must be met according to indications. "Irritating ingesta may require an emetic or cathartic, teething may require lancing of the gums, malaria the use of quinine, and worms the employment of anthelmintics. If the attack is from phymosis or elongated uvula, excision is required."

Croup.—In both the membranous and the spasmodic form of this affection the treatment should generally commence by an *emetic*. They are especially indicated when obstructing croup membranes play a part in producing dyspnœa. "Emetics effect large evacuations, and favor the resolution of the inflammation, while the efforts of vomiting may be the means of detaching and expelling the false membrane, should it have formed." If relief does not ensue on the action of the emetic, two or three grains of calomel, with a like amount of ipecac, may be given every two or three hours; and a dose of castor-oil occasionally, until the full effect of the calomel as a purgative is obtained. Every case of *inflammatory* croup demands the most active, efficient, and energetic treatment. When the exudation extends to the larynx, the course of the disease in children is so rapid and so fatal that the measures for its suppression must be resorted to early. From two to twelve leeches, according to the age of the patient, should be applied over the larynx, and the bleeding should be encouraged by the application of a linseed poultice to the throat. As soon as some relief is obtained, a blister of *cantharidal collodion* should be applied along the lateral aspect of the neck on each side, and not over the trachea. Five-grain doses of the iodide or the chlorate of potassium every two hours have been used with benefit; and the use of the vapor-bath, from 75° to 80° F., is not to be neglected. If some symptoms of amelioration do not follow the use of leeches, emetics, the warm bath, and calomel purgation, pursued for twelve or sixteen hours, *tracheotomy* is almost imperatively called for as a means of prolonging life, and as affording an additional chance of the patient's recovery.

In the early management of "true croup" some emetics are preferable to others. The author has found the most reliable to be a combination of "tartar emetic" and ipecac, as follows: ℞ Vini antimonii, glycerini, āā ʒiv; syrup. ipecac, ℥j. M. Dose, teaspoonful every fifteen minutes until emesis is induced. This formula may afterward be given in small doses, at intervals of two or three hours, to control the fever and the inflammatory symptoms. If, upon the next visit, the child is found with a quick pulse, hot skin, somewhat hurried breathing, and occasional ringing cough, but with no thoracic râles, he directs that it should be kept quiet in bed, comfortably covered, but not with too heavy clothes, and prescribes tinct. veratrum viride, in one- or two-drop doses, according to the age of the child, as, for example, in the following formula: ℞ Tr. veratri viridis, gtt. xvj; spts. ætheris nitrosi, ʒj; syrup. simp., aquæ, āā ℥j. M. Dose, one or two teaspoonfuls every second hour. The child is to be visited as often as every eight hours, and the medicine regulated according to the effect on the pulse. The pulse should be brought down to below eighty per minute. The veratrum is then reduced to half the quantity. If thoracic râles, hurried and labored breathing, and other symptoms, indicate that the disease is extending downward, then something like the following is substituted: ℞ Tr. veratri viridis, gtt. xvj; ammonii carbonatis, ʒss.; syrup. tolu, syrup acaciæ, āā ℥j. M. Dose, teaspoonful every second hour. Sometimes quinine is added to the above formula. When the croup is complicated with broncho-pneumonia, quininæ sulph., in doses of gr. ij–v, should be given separately, thrice daily. Sinapisms, embrocations of camphor and lard, turpentine and lard, or kerosene, to the throat and to the upper part of the chest, aids the treatment. Instead of by emetics, croup, at its outset, may often be cut short by a full cathartic dose of calomel (gr. v–x), which exerts a powerful salutary influence of a sedative or antiphlogistic character. *Spasmodic* croup may also require a cathartic dose of calomel, followed by an emetic, or else nauseating doses of syrup of ipecac. The following is also of great benefit in this variety of the disease: ℞ Chloralhydrate, gr. xvj; ol. olivæ, syrup. ipecac, āā ℥j. M. Dose, teaspoonful every three to six hours, according to age. If the attacks show a periodicity by recurring at night, quinine is especially indicated. It is sometimes used by inunction with glycerine or unguentum petrolei.

Diphtheria.—Regarding this disease as constitutional and primarily due

to toxicæmia, instead of a local affection, as soon as evidence of the malady is noted the patient should be put on the following treatment: ℞ Hydrargyri chlorid. mitis, gr. vj; sodii bicarb., gr. xij. M. Ft. Chart. No. VI. Dose, one every four hours until the bowels are freely moved. Alternately with the above powders the following should be given: ℞ Quininæ sulph., ʒ ss.; ext. taraxaci fluid, elix. simplicis, āā ℥ j. M. Dose, teaspoonful. After the bowels have been freely acted upon, the powders should be omitted, and the following taken alternately with the quinine mixture: ℞ Acidi borici, ʒ j; tr. ferri chloridi, potassii chloratis, āā ʒ ij; aquæ, syrupi, glycerini, āā ℥ j. M. Dose, teaspoonful every four hours for a child four years of age. To secure a better local effect, no water should be taken soon after the last mixture. For topical use by means of an atomizer, the following is efficient: ℞ Acidi salicylatis, ʒ ss.; glycerini, ℥ ij; aquæ calcis, ℥ viij. M. Use a tablespoonful thrice daily. Another excellent solvent for the exudation is lactic acid in the proportion of ♏ xv–xx to ℥ ss. of water, which may be used in the same manner. The following is also one of the best topical applications: ℞ Acidi carbolic, gtt. viij; liq. ferri subsulphat., ʒ ij; glycerini, ℥ j. M. Apply with a camel's-hair brush twice or thrice daily. As the disease advances, the frequent administration of liquid nutritious aliment is very important, as well as alcoholic stimulants. "The less the nourishment the greater the quantity of stimulants. The youngest children may require a teaspoonful of whisky or brandy every two hours; a child three years of age, a dessertspoonful." Some regard alcohol as antidotal to the blood-poisoning, and hence should be used throughout the disease. The whisky and brandy should be given diluted with water or with milk. The paralysis which sometimes follows this disease will require the persistent use of strychnine and iron for several weeks.

Hydrocephalus.—The treatment of this affection in its chronic form requires the use of tonics and alteratives. The following is a suitable remedy: ℞ Potassii iodidi, ℈ j; syrup. tolu, ℥ ss.; aquæ, ℥ ij. M. Dose, teaspoonful morning and evening after food. "Glycerine, with a small quantity of tr. of iodine, should be applied to the scalp twice daily, and the child should wear a close-fitting cap. The strong affinity which the glycerine has for water causes profuse local sweating, and, if the treatment is persisted in, a cure is often accomplished in the course of a few months."

Parotitis.—In the treatment of mumps the swelling of the parotid gland requires the application of fomentations several times a day by means of flannel wrung out of a hot lotion containing an opiate, or turpentine stupes may be employed. A linseed-meal poultice may occasionally be applied. The bowels must be opened by a laxative. Syrup Doveri is a good anodyne febrifuge. Ext. jaborandi fluid, in doses of ♏ v–xxx every four hours until a free flow of saliva is induced, will often afford complete relief within forty-eight hours. Should there be metastasis to the brain, a few leeches may be applied to the temples, the feet immersed in hot mustard-water, and a brisk aperient given every three or four hours. Metastasis to the testicles or mammæ require fomentations and the same general treatment in the way of purgatives, derivatives, and anodynes. "When parotitis occurs in the course of measles or scarlet fever, it is usually significant of an adynamic condition, and requires supporting and stimulant medication."

Pertussis.—The best remedies for this affection are belladonna, bromide of quinine, alumen, and oxide of zinc. Tr. belladonnæ may be given in syrup of orange, morning and evening, and in doses of one drop for each year of age from one to ten. Quinine must be given in quantities sufficient to produce antiperiodic effects: ℞ Quininæ bromidi, gr. xvj; elixir glycyrrh., ℥ ij. M. Dose, teaspoonful every two hours. To a child under three years, eight grains should be administered in the twenty-four hours. Older children will require from ten to fifteen grains. With this formula, actual cures have ·n claimed in two days from its commencement. Alumen is rapidly re- ·ng its previous popularity as a remedy for whooping-cough. Excellent ·s may be obtained from the following: ℞ Ext. belladonnæ, gr. j; alu-

minis, ʒ ss.; syrup. zingiberis, syrup. acaciæ, aquæ, āā ℥ j. M. Dose, teaspoonful morning and night; also in the night, if the cough be troublesome. To relieve cough and to promote rest, chloralhydrate and syrup ipecac is also a useful combination. Potassii bromidum and ammonii bromidum are likewise popular and efficient sedatives. To diminish the "whooping"-cough, they may be combined with belladonna and syrup of wild cherry. In the latter stages of the malady, general exhaustion requires nutritious aliment, alcoholic stimulants, and the ferruginous preparations.

Rubeola.—In infancy and in old age, measles is essentially dangerous, though the danger is not in the disease so much as the sequelæ, which may be of a grave and persistent character. All exposure to cold must be avoided. The patient should be kept in bed and in a darkened room. Milk diet is advisable, and a light diaphoretic mixture indicated: ℞ Syrup. ipecac, tr. opii camph., āā ℥ ss.; liq. ammonii citratis, ℥ j. M. Dose, teaspoonful every two or three hours. In the above formula, if the cough is not troublesome, spts. ætheris nitrosi may be substituted for the paregoric. In "black measles," which is the hæmorrhagic form of the disease and a very dangerous complaint, the system must be actively supported by wine or brandy, and the bronchi kept clear by stimulant expectorants, such as the terebinthinate preparations. Preparations of ammonium increase the disposition to hæmorrhage. The bowels, if costive, should be moved by a mild laxative. Tr. veratri viride may be used in severe cases to reduce the temperature. If in any case the eruption is slow to develop, warm fomentations and sinapisms should be applied to the chest, and whisky "toddy." Spts. ætheris nitrosi, or an emulsion of ammonii carbonas may be administered. The following is an excellent diaphoretic: ℞ Spts. ætheris nitrosi, ʒ ij; liq. ammonii acetatis, aquæ camphoræ, āā ℥ jss. M. Dose, teaspoonful to a tablespoonful, according to age, every two or three hours. In infants, when symptoms of pneumonia arise, they should be met with the following: ℞ Tr. verat. viridis, ♏ viij; tr. opii camph., syrup. ipecac, āā ʒ iv; liquor ammonii acetatis, ℥ ij. M. Dose, half to one teaspoonful every two or three hours for a child one or two years of age.

Scarlatina.—No certain prophylactics are known for this disease; but if belladonna, or tr. ferri chloridi, with digitalis or spts. ætheris nitrosi, do not prevent children from taking the disease, these agents mitigate the severity of the attacks. The last three agents improve the condition of the blood, lessen the fever, and, by diuretic action, tend to prevent the occurrence of renal complications. "They may also eliminate the poison so rapidly and completely as to prevent the disease from reaching its full development." After the establishment of the disease, if moderately severe, the external treatment should be by cold applications to the head and frequent sponging of the body with tepid water. The itching of the skin is best relieved by inunctions with unguentum petrolei. "A hot mustard-bath or foot-bath develops the rash and allays the nervous excitement." It is especially indicated if the temperature is not high, and convulsions occur attended by a disappearance of the rash. In mild cases of the disease the following may be prescribed: ℞ Quininæ sulph., gr. xvj; ext. glycyrrhizæ, gr. x; syrup. pruni Virginianæ, ℥ ij. M. Dose, teaspoonful every fourth hour to a child of three to five years of age. This may be given alternately with the potassium chlorate and iron mixture, hereafter presented. When the *pharyngitis* is severe, moderate quantities of ice may be applied on each side of the neck over the parotid gland. A domestic remedy of some utility consists of the application of a thin slice of salt bacon. It should be stitched to a single thickness of muslin and applied to the throat, reaching from ear to ear. This complication is also benefited by the internal use of the following: ℞ Tr. ferri chloridi, pulv. potassii chloratis, āā ʒ j; syrup. simp., ℥ ij. M. Dose, teaspoonful every two hours. The following is an excellent topical application: ℞ Acidi carbolic, gtt. v; liq. ferri subsulphat., ʒ ij; glycerini, ℥ j. M. Apply with a camel's-hair brush three or four times daily. A quick and efficient method of making applications is afforded by "hand-atomizers."

The following will be found useful mixtures for this purpose: ℞ Acid. boracic, potassii chloratis, āā ʒ j; aquæ, glycerini, āā ℥ ij. M. If the surface of the throat be covered by foul secretions, ℞ Tr. ferri chloridi, ʒ ij; acidi sulphurosi, potassii chloratis, āā ʒ j; aquæ, ℥ ijss.; glycerini, ℥ ss. M. Should the surface of the throat present a diphtheritic appearance, ℞ Acid. boracic, ʒ iij; liq. potassæ, ʒ j; potassii chloratis, ʒ ij; aquæ calcis, ℥ viij; glycerini, ℥ ij. M. The following powder, used every third hour through the "insufflator," is also useful in cases of diphtheritic exudation: ℞ Acidi salicylici, ʒ ij; bismuth. subnitrat., ℥ ij. M. Should the nostrils be invaded at the same time as the fauces, the local treatment of the nares would require the injection, by means of a suitable syringe, of a teaspoonful of the following mixture: ℞ Acidi boracic, sodii chloridi, āā ʒ j; aquæ, ℥ viij. M. This should be applied warm, and used every two or four hours, according to the gravity of the case and the amount of the discharge. Should rheumatism complicate the case, the following prescription is appropriate for a child five years of age: ℞ Ol. gaultheriæ, ʒ j; sodii salicylatis, ʒ ij; syrupi, aquæ, āā ℥ ij. M. Dose, teaspoonful every four hours. And the following liniment may be applied to the joints upon muslin, and covered by cotton wadding: ℞ Acid. carbolici, ʒ j; tr. belladonnæ, ℥ j; ol. camphorati, ℥ ij. M. "In the malignant forms of the disease, when with a temperature at 105° F., and there is drowsiness, delirium, and restlessness, the patient should be immersed in a bath of about 95° F., which must be gradually cooled down to 85°." But as soon as the temperature is reduced and symptoms relieved, the patient should be removed to the bed (without drying the skin) and covered with a sheet and a single blanket. This procedure may be repeated as often as the temperature rises to 103° F. When both are inadmissible, the wet-sheet pack may be employed. Of medicinal agents to reduce excessive temperature, the following might be used: ℞ Quininæ sulph., gr. xxiv; acid. phosph. dil., ʒ iij; tr. digitalis, ʒ j; syrup. aurantii, ℥ ijss. M. Dose, for a child five years of age, a teaspoonful every two hours. If the stomach will not retain the quinine, a single dose of gr. x may be administered by enema. After the high temperature is reduced, if the vital powers begin to flag, alcoholic stimulants and liquid alimentation are required, or the following may be indicated: ℞ Ammonii carbonatis, ʒ ss.; syrup. aurantii, ℥ ss.; liq. ammonii acetatis, ℥ iijss. M. Dose, teaspoonful to a tablespoonful every one, two, or three hours, according to age and urgency of the symptoms. If the urine be scanty or already contain albumen, digitalis should be added to the treatment. This agent is of marked benefit throughout the disease, and in the latter stages it should be given with tr. ferri chloridi. Acute renal congestion demands dry-cupping to the loins, warm fomentations, and saline laxatives. Cathartics of a hydragogue nature may be indicated: ℞ Resinæ podophylli, gr. j; hydrarg. chloridi mitis, gr. v; sacch. lactis, ℈j. M. Ft. in Chart. No. V.-X. S. Give one powder, and repeat according to circumstances. Free action of the skin can be maintained by jaborandi. In azoturia the following should be used: ℞ Pilocarpinæ hydrochloratis, gr. j; aquæ, syrup. aurantii, āā ℥ jss. M. Dose, teaspoonful every hour until free perspiration is induced, and then twice daily until danger of uræmia seems past. Great caution is required throughout this disease in the use of opiates. Chloralhydrate is less objectionable. Milk is the best diet, and should be given *ad libitum*. In many bad cases a little whisky or brandy must be added to eggs, or milk or wine must be allowed. During convalescence, chill and fatigue must be guarded against. "A change of air must not be advised too soon; three weeks indoors for the disease to cease, and three weeks at home after that for restoration of health, is the safest rule for all. No convalescent should mix with susceptible children until six weeks from the seizure, however slight the attack." And if convalescence has been interrupted, or some after-effects of the disease remain, this interval should be two or three weeks longer.

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